Title:	Revision:	Revision Date:
vLBV Operators Manual	**J**	**13 Sep 13**
Document Number: **DOCS-127**		

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User's Manual

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IMPORTANT

Read this manual prior to operation.

Purpose

The purpose of this manual is to provide vLBV operators with a clear understanding of the proper and safe operating procedures. It is a valuable reference tool and should be thoroughly reviewed prior to the operation of the vLBV. If any part of this manual regarding the use of the vLBV is unclear or not thoroughly understood, please contact SeaBotix Inc. or any authorized distributor for more detailed information.

Before operating the vLBV, it is important to read this manual thoroughly to understand the proper use and precautions required for its safe operation. Throughout this manual information of special interest is highlighted with the following symbols. Be sure to read and understand each of these important messages.

Safety symbols

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Indicates a situation which if not avoided could result in data loss or equipment failure.

INFORMATION notes to assist the operator.

Potential Hazards

Although the vLBV is a safe and reliable tool when used and cared for properly, there are certain inherent safety hazards associated with the operation of the vLBV that should be reviewed and avoided. SeaBotix Inc., and its distributors, associates, and affiliates, cannot be held liable for any damages, injuries, losses or problems whatsoever resulting from negligent operation, or a vLBV system that has been altered or modified without the prior written consent from SeaBotix Inc.

Thruster Propellers:

Keep the propellers clear of obstructions at all times.

Do not put fingers or other objects near the propellers at any time.

Be careful with any loose clothing, jewelry, etc.

Three Jaw Grabber:

High closing force, 2.5 bar (36.5 psig) keep clear of the jaws when testing.

Lighting:

Each light head is capable of outputting 1080 lumens, do not look directly into the lights when testing, or during system operation.

If operating with divers, advise them to avoid looking at the vLBV lights.

Electrical Shock

The vLBV operates at high voltages that can cause injury and/or death.

Keep the Surface Power Supply plug away from water.

Check all plugs for the presence of water prior to connecting.

If the tether is cut, chafed, or otherwise damaged, do not operate the vLBV.

Do not open the vLBV electronics housing when the power is on.

Equipment Cooling

.
The vLBV is a water cooled device. DO NOT operate in air for more than 15 minutes, damage may result.

The SPS30XX is an air cooled power supply, for proper cooling both the front and rear covers must be removed.

In addition, when opened for operation, the SPS30XX must be located to prevent water ingress from rain or wave activity.

Testing

Each vLBV system is carefully manufactured to ensure long term safe operation. Prior to shipment, every vLBV is tested for proper operation, including pressure testing to full operating depth. Should a defect be found, contact SeaBotix Inc. or an authorized distributor immediately.

Design and Documentation Changes

SeaBotix Inc., reserves the right to make changes to the specifications of the vLBV and/or alter any documentation at any time, without notice.

Connectors

Connectors used on and in the vLBV system are primarily plug style connectors. Rotation or lateral movement on the connections when mating/un-mating can cause damage to the connectors.

Section 1: Introduction

The vLBV represents a radical new design concept in small ROV's. Upgrades in electronics, and innovative design allow for the incorporation of many new design features, capabilities and upgrades into this small footprint.

Data communications to and from the vLBV is via 100MByte per Sec Ethernet data line. This large bandwidth capability allows us to employ a large optional sensor package load while maintaining a separate video data stream.

Incorporated and available are three (3) RS232 to Ethernet adapters and one (1) RS485 to Ethernet adapter allowing the installation of serial data output sensors for transmission and display to the computer topside.

Numerous electronics upgrades:

Up to 4 (four) attached video sources. Single camera display, that is selectable during vLBV operation.

1 video input is optional as a HD source for up to 1080 video.

Individual head external lights are installed with independent lighting controls. This allows the operator greater control of the lighting to improve video quality, adjusting the lighting to prevent hot spots.

The forward external lights mechanically track the main camera tilt angle.

An optional spot light for attachment to the forward primary camera to improve the video detection range in water with >10m visibility.

An improved Sensor Nav Board with a high resolution digital electronic compass.

Mechanical improvements:

A modular floatation system, designed for neutral buoyancy in the basic system configuration and incorporating locations for additional floatation for accommodating up to 10kG of additional payload.

Three bladed 100mm brushless DC thrusters provide for greater thrust.

Six thrusters with two employed for the vertical axis, and four on the horizontal.

Vectored mounting angles for the horizontal thrusters, with two angles forward, and three angles aft, are providing up to 22.7kG of forward thrust, and up to 15.3kG of lateral thrust. (See table.)

vLBV Thruster Configurations	FWD Angle	Aft Angle	Total Fwd Thrust	Total Lateral Thrust
1	35^0	18^0	21.1 kG	10.5 kG
2	35^0	35^0	19.6 kG	13.7 kG
3	35^0	45^0	18.2 kG	15.3 kG
4	18^0	18^0	22.7 kG	7.4 kG
5	18^0	35^0	21.1 kG	10.5 kG
6	18^0	45^0	19.8 kG	12.1 kG

Configuration three is the factory standard.

The separate sealed electronics module was designed to allow the operator to quickly change out the entire module in the event of an electronics fault, and return to operations in less than 30 minutes.

A comprehensive mechanical and electronic assembly design, with maintainability being as important as ease of operation. All components and assemblies were designed to make replacement of any single component possible in a matter of minutes.

Newly designed removable thruster propeller guards are integrated into the propeller nozzles. When removed, this will reduce the potential for propeller fouling and subsequent damage when operating in areas with floating marine growth, i.e. kelp.

Propeller attachment redesigned as a collet and nut system, making removal and replacement of propellers simpler.

1.1 Unpacking System

The system will arrive individually packed in rugged watertight transit cases protected by cardboard boxes.

The standard basic system will arrive in at least five separate boxes, marked with their primary contents.

The vLBV, the Universal Reel System, the Surface Power Supply, the Integrated Control Console, and a box for spares documentation and software:

Upon receipt, open and visually inspect each case and its contents. Verify that the system is undamaged and that all items ordered are provided.

vLBV (vectored Little Benthic Vehicle)

1. Verify the affixed tag noting the water type for which the vLBV is trimmed for, Salt (Green) or Fresh (Blue).

2. If a Three Jaw Grabber was requested, verify that it is mounted to the cross brace at the bottom of the vLBV.

3. Verify the correct number of external lights, and mounting configuration.

4. Verify the proper number of cameras are installed and their location.

5. Verify additional sensors mounted such as, scanning sonar, multi-beam sonar, tracking or other sensors per the sales order.

NOTE: Due to packaging considerations, some sensors may not be mounted to the vLBV upon arrival, but will be included in the shipment along with instructions for mounting and connecting prior to use.

1. Verify that the delivered reel matches the order.
2. Verify that the reel handle is in place.

SPS30XX (Surface Power Supply)

1. Remove the end caps for the SPS30XX.
2. Verify the correct electrical connectors for your location are installed on the power cables located at the rear of the unit.

NOTE: In some cases, the power cables will not be terminated with a connector, in this case, the wires will be stripped back in preparation for installation of connectors, and a tag will be attached indicating the proper connections by wire color.

ICC (Integrated Control Console)

1. Open the cardboard packing case; inspect the exterior of the case for damage.
2. Open the case; lift the OCU (Operator Control Unit) from its storage location, test operation of the joystick, and the vertical thruster control knob.
3. Visually inspect the monitor for damage.

NOTE: Retain the cardboard container for the ICC. If the ICC requires return to SeaBotix, shipping damage can be prevented by utilizing the original packaging.

Manuals and Cables:

The vLBV documentation, additional cables required for operation, and any software required for operation of installed accessories will be located in a separate package. Utilize the packing list to verify that all items are delivered.

1.2 Power Requirements

Voltage and Power required: 110VAC or 220VAC 4kW minimum.

The SPS3003 is designed to operate on 110VAC. Due to the lower voltage and efficiency, it is recommended that the SPS3001 be powered via separate 20A supplies.

The SPS3004 is designed to operate on 220VAC.

The SPS30XX can be operated on either voltage source; the following considerations need to be observed.

Do not operate the system from an Uninterruptable Power Supply.

It is not recommended to operate the system from a GFI protected circuit.

Any and all primary power connections must have an earth ground reference

Do not utilize signal conditioning circuits on the primary power connections.

Ensure that any extension cords utilized are of sufficient gauge to carry the 2-4kW of power. This can be tested by verifying no more than a 10VAC drop over the length of the cable when under load.

Failing to adhere to the above notices may result in improper vLBV operation or damage to the equipment.

1.3 Setting up the System

The basic system requires only a few cable connections and a power source to be up and running.

It is recommended that the user always start at the vLBV, and work from there to power. In addition, the shackle on the vehicle end of the tether should be attached to the vLBV prior to making any other connections.

DO NOT attempt to connect the tether to the vLBV while voltage is applied. This will result in damage to the electronics of the vLBV.

When connecting and testing the vLBV, a dry well lit work space is recommended. Place the system components on stable surfaces, arranged so that the operator can reach all controls easily.

The vLBV is designed as a water-cooled device. Operation in air should be kept to 15 minutes or less to prevent component damage from heat build up.

It is recommended that the following portions be read completely prior to performing any of the steps. This allows the operator to have a basic understanding of the goals and steps outlined in the proceedures prior to starting.

1.3.1 Universal Reel System (URS)

When setting up the Universal Reel System (URS) there are a few considerations that should be taken into account.

1. Set the reel up so that the tether is deployed off of the spool towards the area where the vLBV will be operated.

2. Route the cables from the Pull Out Hub so that they are protected from traffic and not a trip hazard.

3. Set the URS as close to the water as possible. This will reduce the amount of vLBV tether in a potential transit area.

1.3.4 Surface Power Supply (SPS30XX)

NOTICE

The Surface Power Supply is not water or spray tight when set up for operation. Allowing water into the electronics will cause damage.

Remove the front and rear covers from the SPS30XX

Part Number Breakdown for the SPS30XX:

SPS3003: 110 VAC Supply <250M Tether
SPS3004: 110 VAC Supply >350M Tether
SPS3005: 220 VAC Supply <250M Tether
SPS3006: 220 VAC Supply >350M Tether

.

NOTE: When connected to 110VAC, two separate 20A supplies must be utilized to avoid overloading the wiring.

1.4 Pre-Dive Inspection and System Operability Tests

Prior to placing the vLBV in water for the first time or after repairs, a vacuum test should be performed on the Electronics Bottle Assembly.

The vacuum fitting is located on the aft end of the Electronics Bottle Assembly adjacent to the electrical and fiber optic tether connections. Connect the supplied vacuum pump hose to the vacuum fitting, and verify that the system reads between eight to ten (8-10) inches of mercury vacuum.

1.4.1 Vacuum Test

Locate the vacuum fitting. Use a #2 Phillips screwdriver; remove the 10-32 Phillips head seal screw.

Install the hose fitting for the vacuum test fixture and read system vacuum.

System vacuum should read from 8 to10 in Hg

If the reading is less than eight inches of mercury, the vacuum should be increased to ten inches and held for ten minutes. If the needle moves at all, the Electronics Bottle Assembly fails the vacuum test.

Once the vacuum test is complete, fully connect the system and power the vLBV. Test the operation of all features and devices.

NOTICE

The vLBV is a water cooled device. Do not operate in air for longer than 15 minutes as damage can occur to the electronics.

NOTICE

When testing the vLBV lighting, only operate them in air long enough to verify that they operate, then turn them off. Water cooling is required for extended operation of the light heads.

It is recommended that this step be performed prior to shipping and at least one day prior to operation.

1.4.2 System Inspection

Prior to operation, verify that all components are present, cables, accessories etc.

Visually inspect all portions of the system. Verify that no damage has occurred during the last use, or during transit.

1.4.3 Connecting and Powering up the vLBV

NOTICE

Always connect the system starting with the vLBV and work backwards to the power source. This is to prevent accidental connection of the tether to the vLBV while power is applied. Connecting the tether to the system while power is applied may result in damage to the electronics.

1 Release the reel lock on the URS.

2 Deploy 2-3 meters of tether from the URS (Universal Reel System)

3 Attach the shackle to the pad eye at rear of the vLBV.

4 Remove the protective cap from and connect the Fiber Optic data/video connection to the ST-Dry connector on the rear of the Electronics Bottle Assembly.

5 Connect the 3 pin wet mateable connector to the 3 pin bulkhead connector on the rear of the Electronics Bottle Assembly.

6 Remove the tether whip from the storage posts, and route the cables to the SPS30XX and the ICC/INC. The tether whip connector routes to the SPS30XX and the RJ-45 connector is routed to the ICC/INC.

7 Connect the tether whip connector to the input connector on the SPS30XX.

This connector is keyed. Locate the Red Dot on the male connector, and align it with the Red Dot on the female receptacle on the SPS30XX.

8 Connect the RJ-45 cable to the right hand Ethernet input jack on the SPS30XX.

9 Connect one end of the BNC-BNC (CBA066) video cable to the Video Output connector on the Pull Out Hub of the URS.

10 Connect the other end to the Video Input connection on the ICC/INC.

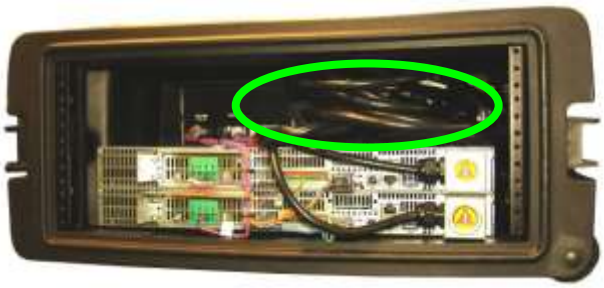
11 Connect the Data Cable (CBA010) from the RS-232 connection on the ICC/INC to the Control connector on the front panel of the SPS30XX

12 Connect the ICC power cable (CBA701) to the ICC.

13 Connect the ICC power cable to power.

14 Connect the SPS30XX to power.

The power cables for the SPS30XX are located in the rear of the case.



15 Turn the power switch on the ICC/INC to the ON position. The Power and Status lights will illuminate.

This breaker only provides power to the ICC/INC and installed electronics. No power is provided to the vLBV from the ICC/INC.

Power up the SPS30XX

16 NOTICE This power up sequence must be followed as written. Deviation from this procedure may result in damage to the equipment.

16A On the SPS30XX turn the power switch to ON (**I**) for the Master power supply

Allow the power supply to finish initialization, until the display on the right reads **Sd POL**

16B This takes approximately 2 seconds. Until the system is providing power to the vLBV, the alarm light and status indicators will flash on the master power supply.

16C On the SPS30XX turn the power switch to ON (**I**) for the Slave power supply

Allow the Slave power supply to finish initialization, until the display on the right reads.

16D This takes approximately 2 seconds. Once both master and slave power supplies have initialized, the display will read as shown.

Turn the SPS3000 controller (in the SPS30XX) power switch on. The red POWER light will illuminate, then after 2 seconds the amber STATUS light will illuminate.

16E Do not proceed to system power up until the amber light is lit.

Press the power key on the Operator Control Unit.

17

The operator will hear the Master and Slave power supplies increase noise output. This indicates that they are supplying power to the vLBV.

18 The amber status light on the SPS30XX will now begin to strobe, 2 seconds' on/2 seconds off.

19 Verify the voltage output panels on the Master and Slave power supplies read the correct output voltage and current.

The Voltage displayed will vary depending on Tether length.

18 Operate thrusters, using the joystick on the OCU, and verify that the current reading on the Master and Slave power supplies show an increase in output.

The current increase will be slight, but noticeable.

20 Verify that video is displayed on the ICC/INC monitor.

21 Verify the overlay information is displayed and all values are as expected.

System power up sequence complete.

1.4.4 Operational testing

Operational testing involves verifying that all components are functional.

1. Verify video present from all installed cameras.
2. Verify that all thrusters operate.
3. Verify all installed lights operate.
4. Verify all installed accessories operate.
5. Verify all installed external sensors operate.
6. Check the compass heading displayed on the video overlay, and verify that it is correct.

The compass output can be affected by ferrous metal and electrical power transformers in close proximity to the vLBV. Test the compass at least one meter away from these materials.

7. Verify the depth sensor output is at or near zero in air.

The vLBV should be in view of the operator or if available a second person in communications with the operator can be used to assist.

NOTICE The vLBV is designed for water cooling. Do not operate in air for longer than 15 minutes as damage can occur to the electronics.

1.4.4.1 Thrusters

Using the Operator Control Unit (OCU) press the joystick to full forward. All four thrusters on the horizontal axis will operate. Verify all propeller blades spinning. Aft mounted thrusters clockwise and forward mounted anti-clockwise.

Rotational reference for thrusters is with the operator looking directly at the propeller end of the thruster.

Using the OCU press the joystick fully to the rear. All four thrusters on the horizontal axis will operate. Verify all propeller blades spinning fwd mounted thrusters clockwise and aft mounted anti-clockwise.

Using the OCU, rotate the control knob at the top of the joystick fully clockwise. Starboard aft thruster will run anti-clockwise, starboard fwd thruster will run clockwise. Port aft thruster will run clockwise; port fwd thruster will run anti-clockwise.

Using the OCU, rotate the control knob at the top of the joystick fully clockwise. Starboard aft thruster will run clockwise, starboard fwd thruster will run anti-clockwise. Port aft thruster will run anti-clockwise; port fwd thruster will run clockwise.

To verify rotational direction, the operator may need to reduce the rate of thrust, by backing off the joystick controls.

Using the OCU; rotate the vertical thruster control knob to full dive. Verify that both port and starboard vertical thrusters rotate clockwise.

Using the OCU; rotate the vertical thruster control knob to full surface. Verify that both port and starboard vertical thrusters rotate anti-clockwise.

1.4.4.2 Camera/s

Since the vLBV can use multiple cameras, the operator should verify video output from each installed camera.

If multiple cameras are installed, the process for selecting the displayed camera is to press and hold the camera button while selecting the desired camera's number.

2= Bow (Primary) Camera
5= Zoom Camera (Bow Secondary)
7= Port
9= Starboard
0= Aft

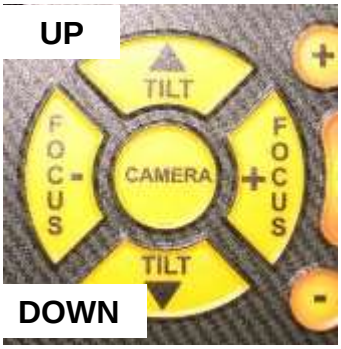
Default camera for display on vLBV power up is the primary camera: (Camera Selection 2.)

Bow Zoom, Port, Starboard and Aft cameras are optional.

After verifying video output from all installed cameras, the operator should verify the tilt control and readings for the forward mounted camera/s.

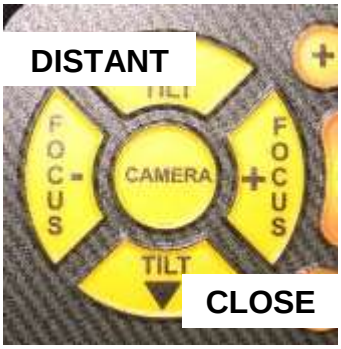
Use the tilt up and tilt down buttons on the OCU to drive the forward camera/s to full up and full down position. Verify that the overlay displays +90CA for full up and -90CA for full down.

Return the camera to 00CA and visually verify that it is centered with the vLBV.



If the cameras equipped have variable focus, verify the focus controls operate. Press FOCUS + for close focus and FOCUS – for distant focus.

Experience shows that a focus range of approximately 1.5m provides good focus range and depth of field for most operational requirements.



1.4.4.3 Lighting

NOTICE When testing the vLBV lighting, only operate them in air long enough to verify that they operate, then turn them off. Water cooling is required for extended operation of the light heads.

The external lighting heads on the vLBV are individually controlled for both operation and brightness levels. Each light has 10 brightness settings, 1-10. 1 being the dimmest and 10 being the brightest.

To select the light to be controlled, press and hold the light button while pressing the number corresponding to the light you want to control.

Once the light/s is selected, press and release the **LIGHT** button again to turn on the selected lights.

To increase or decrease the light level of the selected light, press the + or – buttons located above and below the LIGHT button.

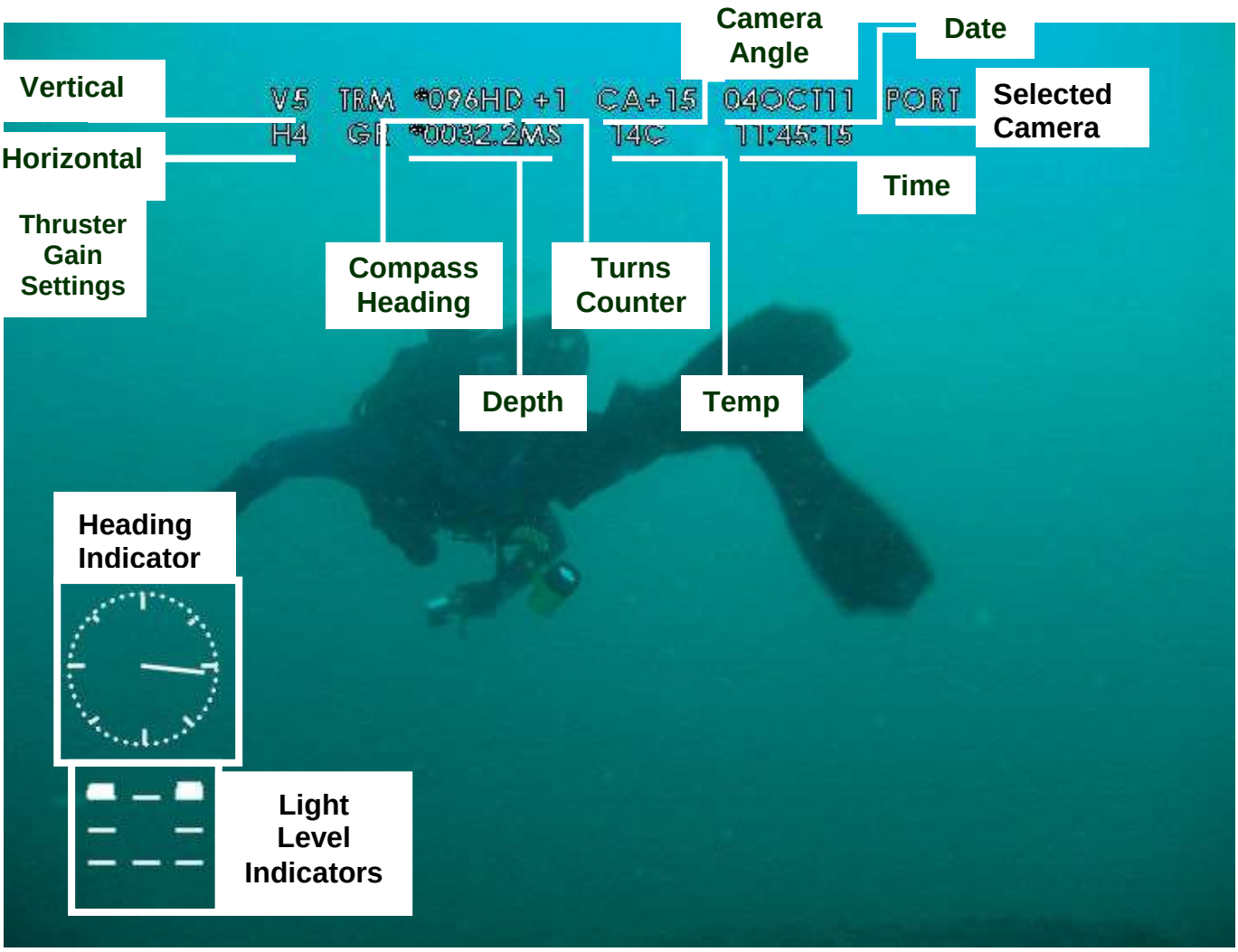
To turn the selected light off, press and release the **LIGHT** button. When the selected light is turned back on, it will turn on at the level it was turned off at. i.e. If light selection 2 was at level 7 when turned off, it will turn back on at level 7.

1 Upper Port Fwd	**2** Joint control of 1 & 3	**3** Upper Starboard Fwd
4 Lower Port Fwd	**5** JKL	**6** Lower Starboard Fwd
7 Port Side Light	**8** Spot Light	**9** Starboard Side Light
* PGRM	**0** Aft Light	# ENT

1.4.4.4 Video Overlay

The video overlay displays information to assist the operator in the piloting and control of the vLBV.

Information displayed is: the vertical and horizontal thruster gain settings, the vLBV heading and turns counter, camera angle depth, and water temperature.



Depth can be displayed in metric or imperial measurement. The depth can also be set for operation and accurate reading for fresh or salt water. If depth output is set to metric, the temperature is displayed in Celsius. When depth is set to imperial the temperature is displayed in Fahrenheit.

The default position for the video overlay is bottom. For ease of reading, it is displayed at the second alternative (top) position in this manual.

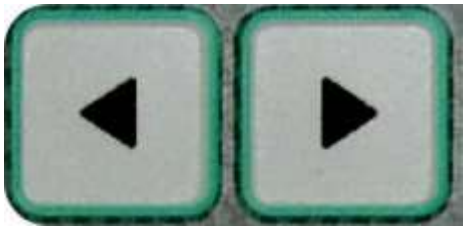
For additional information regarding the video overlay, refer to Section 2.2.

1.4.4.5 Accessories

Accessories refers to SeaBotix designed and installed equipment i.e. the Three Jaw Grabber.

The operator should press the select button on the operator control unit, cycle between all installed accessories, and verify operation.

For the Three Jaw Grabber, the left arrow button closes the jaws.



For the Three Jaw Grabber, the right arrow button opens the jaws.

1.4.4.6 Optional Sensors

Optional sensors: refers to third party equipment that was installed and integrated into the vLBV.

This would include devices like:

Scanning Sonar
Multi-Beam Sonar
Acoustic Tracking Systems
Echo Sounders/Altimeters
Thickness Gauges
Water Quality Probes etc…

Connect your computer to the Ethernet output jack on the ICC/INC, open the manufacturers' operational software, and verify operation of the device or devices.

NOTICE

Read the manufactures manual supplied with the system. Special attention should be paid to all safety notices to avoid damage to the equipment.

1.4.5 Disconnecting the system

NOTICE Never attempt to disconnect any portion of the vLBV system while power is applied. Equipment damage will result.

1 Press the power button on the operator control unit.

2 Turn the power switch on the SPS3000 controller module in the SPS30XX to the off (down) position.

Once this switch is turned off, no power can transfer to the vLBV.

3 Turn off the Slave power supply on the SPS30XX

4 Turn off the Master power supply on the SPS30XX.

5 Turn off the power switch in the lower panel assembly of the ICC/INC.

6 Unplug the power cables for the SPS30XX and stow them.

7 Unplug the power cable for the ICC/INC, and disconnect it from the side panel. Re-install the protective cap.

8 Unplug the video cable from video port and re-install the protective cap.

9 Unplug the Ethernet input cable and any Ethernet output connections made.

10 Unplug the data cable connection from the ICC/INC.

Place the OCU in the storage pocket of the lower panel assembly of the ICC/INC, close and latch the lid.

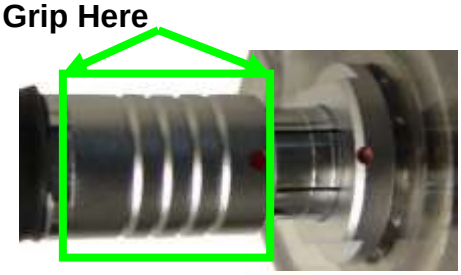
11 NOTICE

NOTE: The OCU is placed face down in the ICC, and face up in the INC.

12 Disconnect the data cable from the SPS30XX.

Disconnect the Tether Whip connector from the SPS30XX.

Grip Here



13 NOTICE

To unplug, pull straight back on the locking collar. Do not attempt to twist the connector. Damage to the connector will result.

14 Install front and rear covers to the SPS30XX.

15 Disconnect the video cable from the video out connection on the Pull Out Hub of the URS. Re-install the protective cap.

16 Coil the tether whip on the whip storage posts on the Universal Reel System (URS).

17 Remove the handle from the reel frame, install in the center of the URS hub and prepare to recover the tether.

18 Disconnect the electrical 3 pin connector from the Electronics Bottle Assembly.

19 Disconnect the fiber optic connector from the Electronics Bottle Assembly. Re-install the protective cap.

20 Spool the tether back onto the URS and set the reel lock.

1.5 Post Dive Inspection

After recovering the system, a visual inspection is recommended to check for debris, fouling or equipment damage that may have occurred during operation.

1. Check all thrusters for fouling or damage. Verify the propeller guard is undamaged, and that all 3 blades are present on the propeller.

2. Inspect the light heads for damage.

3. Check the oil compensation bladders on each of the 6 installed thrusters for damage, air bubbles, and proper oil fill level.

4. Inspect the frame for damage.

5. Inspect the grabber for damage missing hardware or fouling.

6. Inspect all installed sensors for damage or fouling

1.6 Calibrating the Compass

This menu section is under revision.

NOTICE	Do not attempt to perform any of the menu items listed in this section of the vLBV menu. It will erase the compass calibration resulting in incorrect heading information.

Please visit www.seabotix.com or contact our service department at service@seabotix.com for updates and information.

1.7 Trimming the vLBV

The vLBV was trimmed at the factory for either 32 ppt salt water at 19C, or fresh water at 19C. This selection was made at the time of order.

Adjustment of the trim is required for your specific operating conditions. A properly trimmed system significantly eases operation.

If equipment is added or removed from the vLBV, the trim will have to be adjusted.

When trimming the vLBV you are adjusting it for neutral buoyancy, and level trim. Level side to side, and level fore and aft.

To adjust the trim, set the vLBV with tether connected into water of the salinity and temperature that matches to operating area. There should be about 2 meters of tether in the water with the vLBV. If equipped with a grabber, the grabber needs to be extended to deployment position, all accessories that will be utilized must be installed.

NOTE: The system does not need to be powered on for this operation.

1. Place the vLBV in water of approximately the same salinity and temperature as will be found at the operating location.

NOTE: If you are dockside or water conditions are relatively calm, the procedure can be accomplished at the work site.

2. Check the trim of the vLBV by visually inspecting how the system sits in the water. If the vLBV sinks, weight will have to be removed, if it floats, check for level fore and aft, side to side, and verify that it is close (+/- 6 grams) to neutral.

When properly trimmed, the system will float just at the surface of the water, and the addition of 1 SS fender washer provided in the trim kit will cause the vLBV to gently descend, and removal will allow it to surface.

NOTE: The blue dashed line indicates where the water level should be without any top mounted devices.

3. If additional weight is required, the weights are listed at right for the plated tungsten steel trim weights. The thinner supplied SS fender washers weigh 6 grams ea.

4. Place weights at the 4 corners of the vLBV till the proper trim is obtained.

Level fore to aft, side to side.

5. Once the ballast has been determined, mount the weights to the vLBV at the ballast mounting points at the 4 corners of the lower section of the bumper frame then secure them with the nylon wing nut.

1.8 vLBV Storage

Prior to storage, the vLBV should be rinsed and dried. Low pressure air can be used to speed the drying process.

All provided connector caps should be installed prior to storage.

1. Place the vLBV in the provided transit case.

2. Place the URS in the provided transit case.

3. Install the SPS30XX front and rear covers after stowing the power cables inside the frame.

4. Place the OCU joystick down in the lower panel assembly of the ICC/INC and close the lid on the ICC/INC.

Store the system in a clean dry space.

NOTE: If the system is to be stored for more than 3 months, it is recommended that the 50 hour maintenance be performed prior to operation after storage to ensure adequate lubrication on the shaft seals for the thrusters.

Section 2 vLBV Controls

2.1 Operator Control Unit (OCU)

The Operator Control Unit controls all features of the vLBV.

The Horizontal movement of the vLBV is controlled by the joystick, and the vertical thruster movement is controlled by the vertical thruster knob.

2.1.1 Power

The power button is used to turn the power on to the vLBV. Once selected, the red LED above the power button will light.

2.1.2 Numeric Keypad

The numeric keypad has several functions. It is used to select the displayed video camera, select the light head for control, set horizontal and vertical thruster gain settings, assessing and navigating the menus and entering text.

Numbers 1-9 also have assigned alpha characters for text entry.

2.1.3 Control of Horizontal Movement

The joystick controls the 4 horizontal plane thrusters. Movement of the vLBV mirrors the controls: push the joystick left to move left, push forward to move forward…

2.1.4 Turning the vLBV

Rotation of the top portion of the joystick causes the vLBV to turn in the same direction as the knob is rotated.

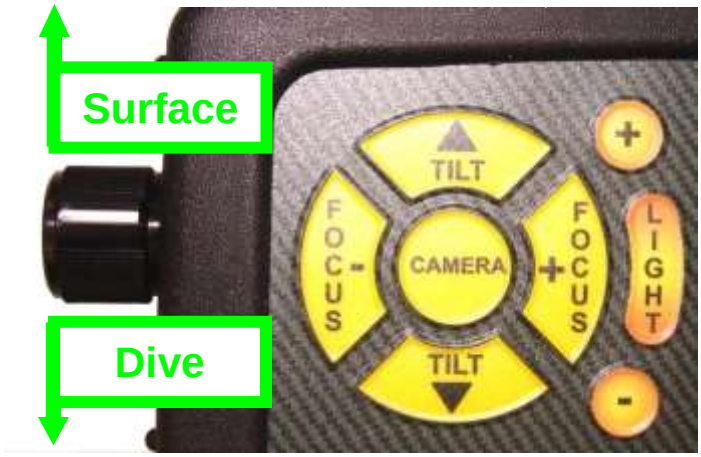
Rotate anti-clockwise = Turn to port

Rotate clockwise = Turn to starboard

2.1.5 Vertical Thruster Control

The vertical thruster control knob is located on the left side of the OCU. The default control settings are: rotation forward will drive the vLBV upwards (Surface), and rotation towards the operator will drive the vLBV down (Dive).

NOTE: This control is not spring return to center, so the operator must manually return it to the center position to stop the vertical thrusters.



2.1.6 Thruster Gain Control

The vLBV thrusters have 10 gain settings (1-0) that are user selectable. The default setting for both horizontal and vertical is Gain 5 when the vLBV is powered on.

To change the level, press and hold either the HORIZ or VERT button and press the new value 1-0.

1=10%...5=50%...0=100%

2.1.7 Camera Selection

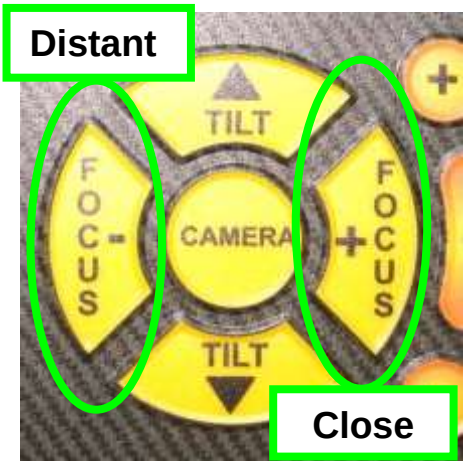
If multiple cameras are installed, the process for selecting the displayed camera is to press and hold the camera button while selecting the number of the desired camera.

2= Bow (Primary) Camera
5= Zoom Camera (Bow Secondary)
7= Port Camera
9= Starboard Camera
0= Aft Camera

Default camera for display on vLBV power up is Camera Selection 2 the primary camera.

All other camera positions are upgrade options.

2.1.8 Focus Controls



To adjust the camera focus, press the FOCUS + button to adjust for close objects, press the FOCUS - to adjust for distant objects.

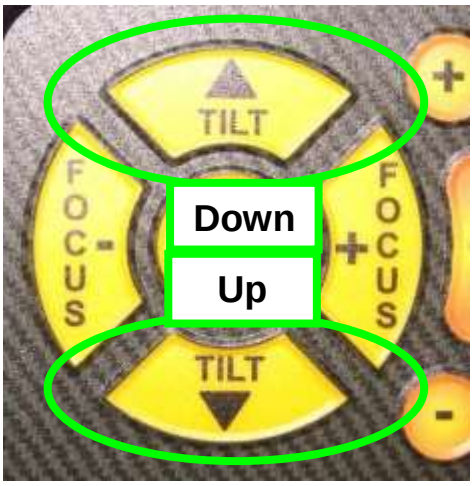
NOTE: This option will only be available on cameras with variable focus.

To return to Auto Focus, Press the **AUX** key and the **1** key simultaneously on the keypad.

2.1.9 Camera Tilt Control

Only the forward mounted camera or cameras have tilt control. The factory default setting is operation of the tilt arrow pointing away from the operator will tilt the camera up, and operation of the arrow pointed towards the operator will tilt the camera down.

Arc of travel for the camera is +90 degrees up and -90 degrees down.



2.1.10 Zoom Control

For cameras with variable zoom, control of the zoom function is via the numeric keypad.

The operator first selects the camera with zoom capability as the active camera following the procedure outlined in 2.1.7

Then use the number 1 key to zoom in.

Use the number 4 key to zoom out.

2.1.11 Lighting Control

The external lighting heads on the

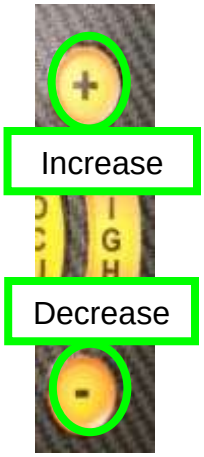
vLBV are individually controlled for both operation and brightness levels. Each light has 10 brightness settings, 1-10. 1 being the dimmest and 10 being the brightest.

To select the light to be controlled, press and hold the LIGHT button while pressing the number corresponding to the light you want to control.

Once the light/s is selected, press the **LIGHT** button to turn on the selected lights.

To increase or decrease the light level of the selected light, press the + or – buttons located above and below the LIGHT button.

To turn the selected light off, press the **LIGHT** button. When the selected light is turned back on, it will turn on at the level it was turned off at. i.e. If light selection 2 was at level 7 when turned off, it will turn back on at level 7.



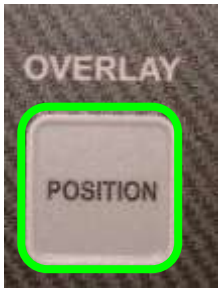
1 Upper Port Fwd	**2** Joint control of 1 & 3	**3** Upper Starboard Fwd
4 Lower Port Fwd	**5** JKL	**6** Lower Starboard Fwd
7 Port Side Light	**8** Spot Light	**9** Starboard Side Light
* PGRM	**0** Aft Light	# ENT

2.1.12 Accessory Control

To select a device, press the select button on the OCU, the overlay will display the abbreviation for the selected device. The operator then uses the right and left triangle buttons to control the device.

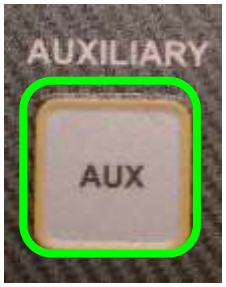
NOTE: Sonar's and other sensor devices are not accessories, they are Optional Sensors.

2.1.13 Overlay Position Control



The default display position for the video overlay information is bottom center of the video. By pressing the position button the operator can move it to the top of the display or turn it off. Each press of the position button will cycle the overlay to the next display position.

2.1.14 Aux Controls

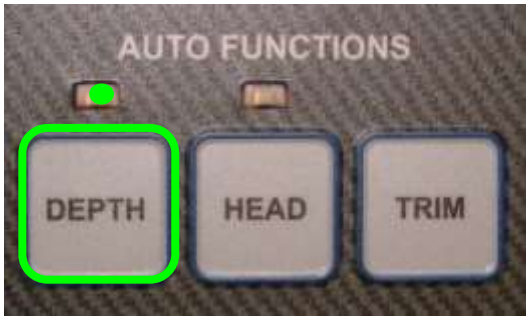


The Auxiliary button is used for re-enabling the auto focus option for cameras with that option. Press and hold the AUX button and select the number 1 on the keypad.

2.1.15 Auto Functions

Included in the controls are three auto functions that when enabled by the operator, give primary control of that function over to the processor board inside the electronics bottle of the vLBV.

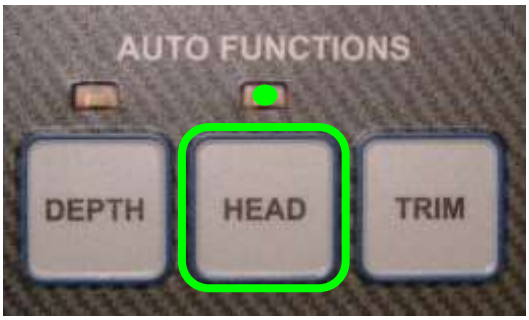
2.1.15.1 Auto Depth



Auto depth is used to hold the vLBV at a desired depth. The operator maneuvers the vLBV to the desired depth, and presses the DEPTH button to engage the feature.

When enabled, the green LED above the depth button will light, and asterisk will display on the video overlay to the left of the vLBV depth.

2.1.15.2 Auto Heading

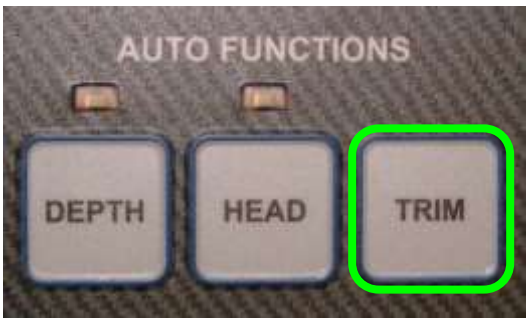


Auto heading is used to hold the vLBV on a desired compass heading. The operator turns the vLBV to the desired heading and presses the HEAD button to engage the feature.

Control can be taken by the operator, and when adjusted using rotation on the joystick, the system will automatically lock to the corrected heading.

When enabled, the green LED above the HEAD button will light, and asterisk will display on the video overlay to the left of the vLBV heading.

2.1.15.3 Auto Trim



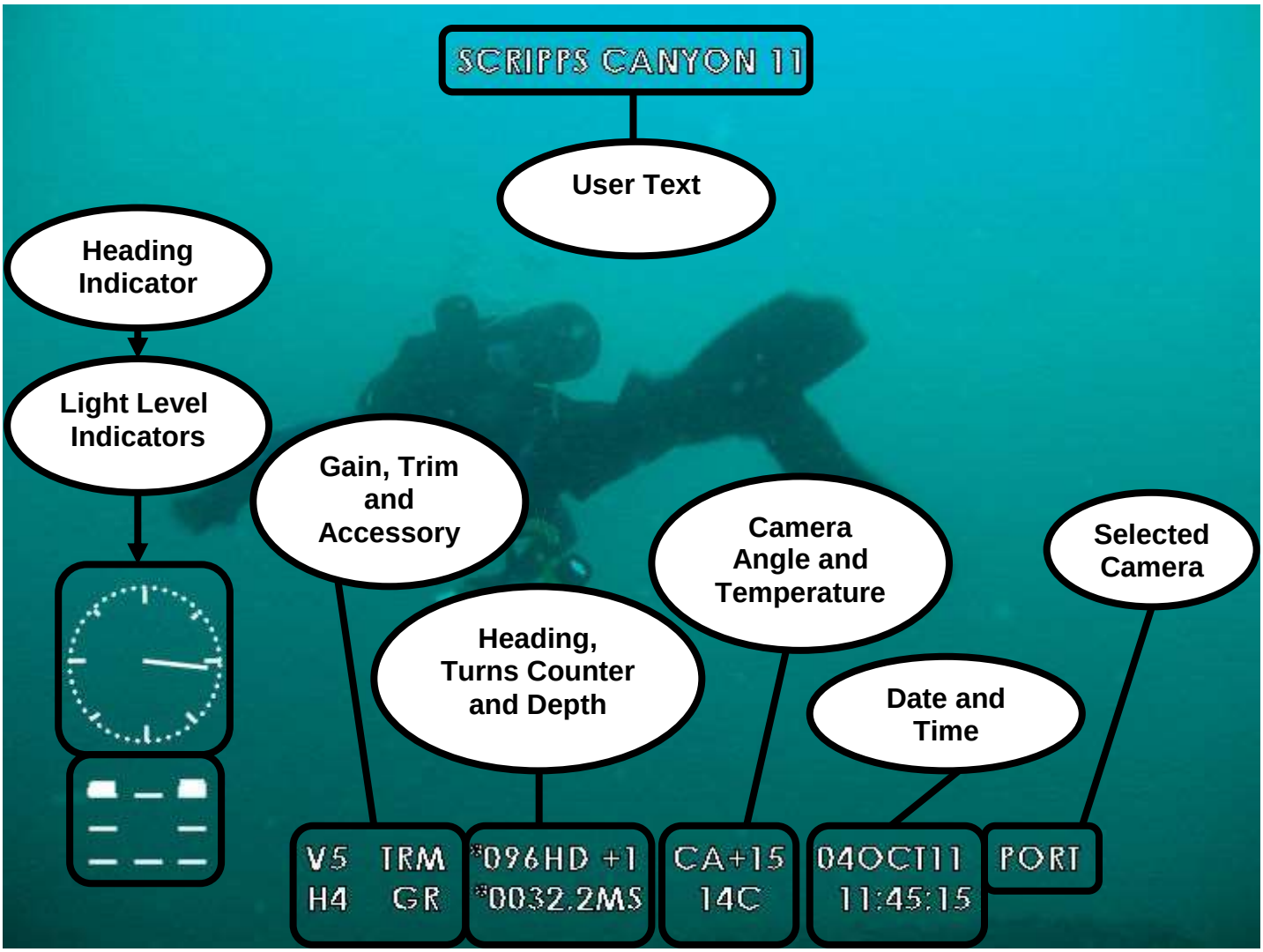
The TRIM button operates much like cruise control. The operator sets the speed of the vLBV using the Joystick and Vertical thruster control knob. The operator presses the TRIM button and the system then maintains those thruster settings once the joystick is released, and the vertical thruster control knob is returned to center.

When selected, the letters TRM will display on the top line of the video overlay to the right of the vertical thruster gain setting.

2.2 Video Overlay

Video overlay is a series of alphanumeric characters embedded into the video stream from the vLBV that displays for the operator operating parameters.

The vLBV overlay data is displayed, default at the bottom of the screen. The operator can change the position by pressing the position button on the OCU.



2.2.1 User Text

By following the instructions in Section 2.3.3, the operator can enter up to 17 alphanumeric characters that will be displayed on the video at all times.

No special characters are implemented at this time. (Examples: &, *, %, $..)

2.2.2 Gain Control, Trim and Light Level Indicator

Vertical Thruster Gain: A numeric value from 1-0 will be displayed after the V to indicate the current gain setting. 1=10%, 2=20%...0=100%

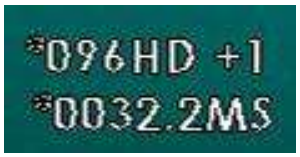
Horizontal displayed after the H to indicate the current gain **Thruster Gain:** A numeric value from 1-0 will be setting. 1=10%, 2=20%...0=100%

Trim: This setting indicates that the operator has set the thrusters to operate at the last position of the joystick and vertical thruster control knob. When selected, this function operates like cruise control for an automobile. The overlay displays this as a reminder for the operator that the function is enabled.

Selected Accessory: When the operator selects an accessory to control via the OCU, the overlay will display the selected component. In this case, the Three Jaw Grabber is selected (GR).

2.2.3 Heading and Depth

Heading: This portion of the overlay displays two pieces of information. The compass heading of the vLBV and the number of full turns that the vehicle has made. A value proceeded by the minus sign (-) indicates turns anti-clockwise. If the value is preceded by a positive (+) sign, the turns are clockwise.



Depth: Depth can be displayed in one of four measurements.

MS=Meters of Saltwater **FS**=Feet of Saltwater
MF=Meters of Freshwater **FF**=Feet of Freshwater

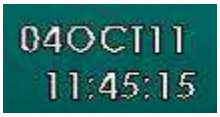
Because each water type has its own density, the operator should ensure that the measurement is set to ensure accurate depth readings.
Refer to Section 2.3.3.2 for instructions on changing the measurement.

2.2.4 Camera Angle and Temperature

Camera Angle: Camera angle is displayed as a positive or negative value from +90 through 0 to -90. Positive values are for upward looking angles and negative values are looking down.

Water Temperature: Water temperature is displayed in either Celsius or Fahrenheit. The scale is determined by the depth measurement setting. If depth is set to feet, the temperature is displayed in Fahrenheit, if depth is set to Meters, then the temperature is displayed in Celsius.

2.2.5 Date and Time



Date: The date is displayed in the international format of DDMMMYY.

Time: The time is displayed as a 24 hour clock. HH:MM:SS

2.2.6 Selected Camera

BOW Primary navigation camera, selection 2 on the keypad. Default camera on power up of vLBV.
ZOOM: Zoom Camera, normally mounted forward, selection 5 on the keypad.
PORT: Port side looking camera, selection 7 on the keypad.
STBD: Starboard side looking camera, selection 9 on the keypad.
AFT: Aft facing camera, selection 0 on the keypad.

2.3 Menus

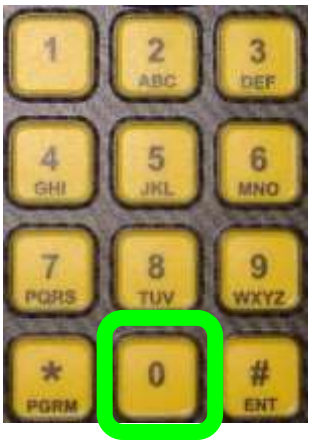
The menus allow the operator to select, display and control all of the standard features of the vLBV.

2.3.1 Quick Access Menu

The quick access menu is the entry point for all other menus.

To access the Quick Access Menu screen press the PRGM key on the numeric keypad of the operator control unit.

The video overlay will now display the Quick Access Menu option screen.



Press the 0 button to continue

2.3.2 Main Menu

In the Main Menu, the operator has four selections.

1. Setup

2. Calibrate

3. Diagnostics

4. Options

Select the corresponding number on the keypad.

2.3.3 Setup menu

The setup menu allows the operator to:

1. Set date and time

2. Change units of measurement and water type

3. Enter user text

4. Reset to default

2.3.3.1 Date/Time

Adjusting the date and time allows the operator to synchronize the system clock in the vLBV to local time, or to a master time clock used for controlling operations.

When option one is selected at the main menu screen, the operator is prompted to set the date then the time for the vLBV.

The operator is first prompted to enter the numeric value for the date.

After adjusting the value, or if no adjustments are needed, the operator can press the ENT button on the numeric keypad to save the changes.

The month is entered as a numeric value, 1 for January…12 for December

This process is repeated for the year, hours, minutes and seconds.

2.3.3.2 Units/Water Type

The system is designed to accurately calculate water depth for both fresh and salt water. The display can be set for imperial measurement, (feet) or metric measurement, (meters).

1. **MF** Meters of Freshwater
2. **MS** Meters of Saltwater
3. **FF** Feet of Freshwater
4. **FS** Feet of Saltwater

The designator MF, MS, FF, or FS will display to the right of the depth reading on the bottom line of the video overlay.

2.3.3.3 User Text

When user text is selected, the operator enters alphanumeric characters to display on the video overlay.

Each character is entered individually, and the ENT key must be pressed to proceed to the next character. To add a space, press the enter key twice after the last character.

No special characters are available (i.e. *, #, $)

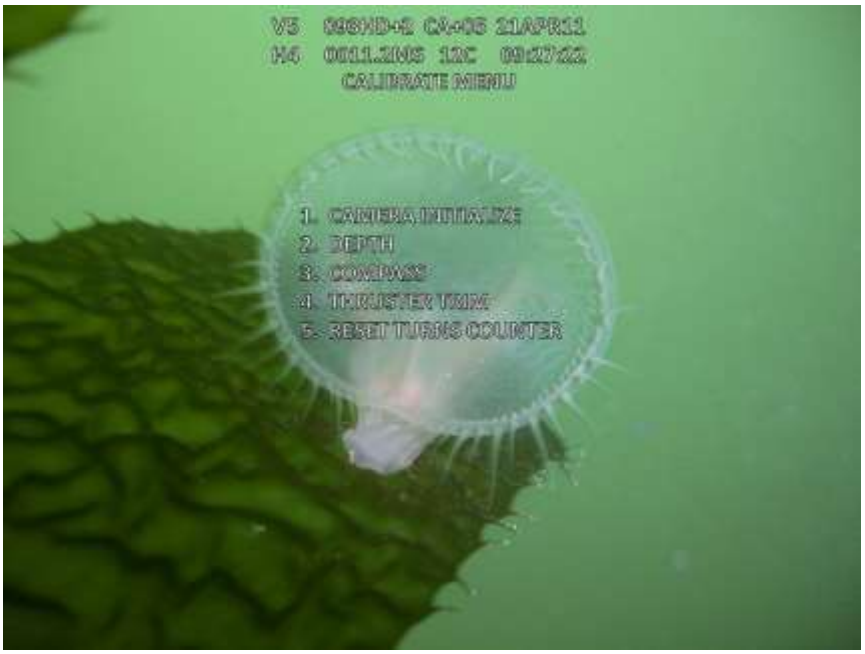
This information will be displayed at all times until the operator turns the feature off by selecting user text again, pressing the enter key, then exiting the menu.

2.3.3.4 Reset to Default

The reset to default selection is used to reset all date, time and user text to the default settings.

The date and time will be set to the value in the program, user text will be erased.

2.3.4 Calibrate Menu



The calibration menu allows the operator to calibrate the standard sensors on the vLBV.

1. **Camera Initialize**
2. **Depth**
3. **Compass**
4. **Thruster Trim**
5. **Reset turns counter**

1. Camera Initialize: When selected, the camera will drive to the maximum up angle (+90 degrees), set the angle, then return to zero for operation. This feature calibrates the tilt angle indicator for the primary camera.

2. Depth:

The calibration options for depth are:

1. **Set Depth**
2. **Set to Zero**

1. Set Depth: This option is used to calibrate the depth sensor to a known depth. When operating in an area with known depth information, the vLBV depth can be adjusted to display the measured depth.

2. Set to Zero: This option should be used when the vLBV is on the surface prior to each deployment.

2.3.4.1 Compass Calibration

This menu section is under revision.

Do not attempt to perform any of the menu items listed in this section of the vLBV menu. It will erase the compass calibration resulting in incorrect heading information.

Please visit www.seabotix.com or contact our service department at service@seabotix.com for updates and information.

2.3.4.2 Thruster Trim

The thruster trim feature allows the operator to individually adjust the gain level of each horizontal thruster. This feature can be used to compensate for the drag caused by flying the vLBV with an externally mounted attachment.

For example, while flying with a grabber mounted to the starboard side of the vehicle, the vehicle will naturally rotate to starboard. Using the thruster trim feature allows the operator to reduce the speeds of the port thrusters and compensate for the drag effect of the grabber.

To do this, the operator can set the gain values for each port thruster on a scale ranging from -100 to +100. A value of +50 will cause the port thrusters to operate at half gain. A value of -50 will cause the port thrusters to rotate backwards at half gain.

These settings should only be adjusted by an experienced operator. Incorrect settings can cause the vLBV to operate opposite the operators intentions, and could result in damage to or loss of the vehicle.

SeaBotix recommends that the operator only adjust the rotate portions of this menu to assist the operator in controlling the turn rate of the vLBV.

The operator first selects the desired direction for adjustment using the numeric keypad on the Operator Control Unit.

1. **Lateral to Port**
2. **Lateral to Stbd**
3. **Longitudinal to Aft**
4. **Longitudinal to Fwd**
5. **Rotate to Port**
6. **Rotate to Stbd**

Here we have selected Lateral to Port.

The operator then selects the specific thruster for trim adjustment.

1 **Port Fore**
.
2 **Port Aft**
.
3 **Stbd Fore**
.
4 **Stbd Aft**
.

To enter a value, use the numeric keypad on the Operator Control Unit.

To set a negative value, the operator enters 0 on the keypad, then type the new value followed by the enter key.

This step will be performed for each thruster to be adjusted.

Changing the rotation will require the same operations, with the operator adjusting each thruster.

1. **Port Fore**
2. **Port Aft**
3. **Stbd Fore**
4. **Stbd Aft**

If the vLBV is heeling to port, the operator should adjust the starboard thrusters to a lower setting for Longitudinal To Port and leave the Port thrusters at the normal value.

2.3.5 Diagnostics System

The diagnostics system menu allows the operator to review each thruster, and the voltage levels for each module power supply.

Once the system menu has been selected, the operator can now choose from the following selection.

1. **Thruster Motors**
2. **Voltage Monitor**

Selecting Thruster Motors will display the options available to monitor each thruster.

1. **Port Forward**
2. **Port Aft**
3. **Port Vertical**
4. **Starboard Forward**
5. **Starboard Aft**
6. **Starboard Vertical**

As each thruster is selected, the system will display the following information.

Revision:	Software revision programmed into the motor controller board.
Current:	Current being drawn by the thruster.
Speed:	RPM of the thruster.
Temp:	Temperature inside the thruster housing.
Fault:	Fault status reported by the controller board.
Serial #:	Serial number programmed for the controller board in the thruster.

When Voltage monitor is selected, the system will display the voltage measurements from each of the power supply circuits.

2.3.6 Software Version

This displays the software version level of each portion of the system.

Once selected, the system will display the first page of the software versions.

1.	Next Page
OCU VERSION	This displays the firmware version for the Operator Control Unit
VCP VERSION	Vehicle Control Processor firmware
VCP BOOT REV	Vehicle Control Processor boot loader revision
VCP EIOP VER	Vehicle Control Processor Ethernet IO Processor firmware
VCP EIOP BOOT REV	Vehicle Control Processor Ethernet IO Processor boot loader revision

Selecting option 1 will display the next page of software information.

When **Next Page** is selected the system will then display the Navigation processor software revision page.

NAV VERSION	Displays the firmware value for the NAV board.
NAV BOOT REV	Displays the boot loader revision for the NAV board.
NAV EIOP VER	Displays the firmware version for the NAV board Ethernet IO Processer.
NAV EIOP BOOT LOADER REV	Displays the boot loader revision for the NAV board Ethernet IO Processor.
COMPASS REV	Displays the firmware revision for the compass board.
IO CONN REV	Displays the firmware revision for the IO Controller board.

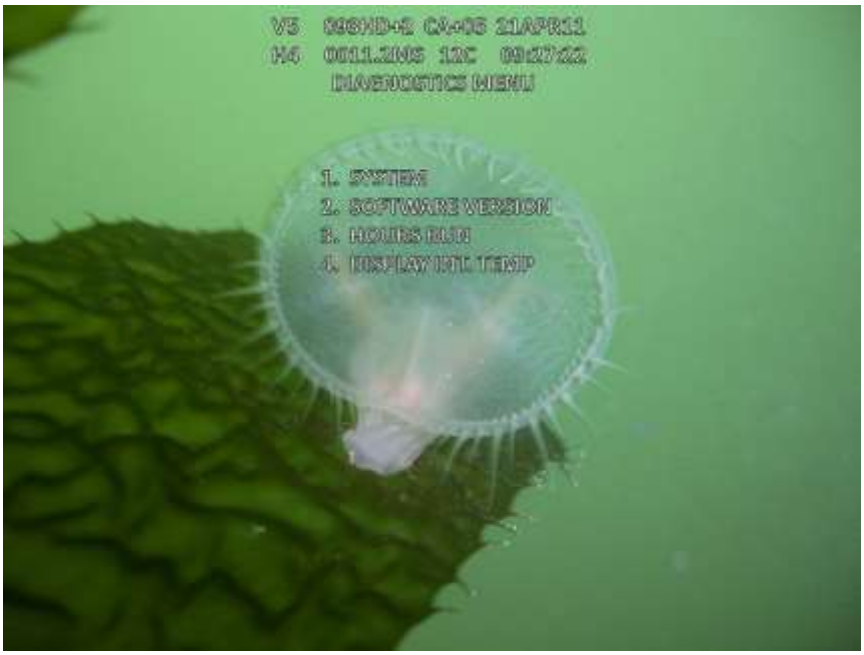
2.3.7 Hours Run

To find out how many hours the system has been run the operator must enter the diagnostics menu from the main menu by selecting option 3.

The counter only counts the total time that the system is turned on, it does not differentiate between operational and non-operational hours.

2.3.8 Display Int. Temp

To display the internal temperature of the electronics bottle of the vLBV, the operator selects item 4 from the Diagnostics Menu.

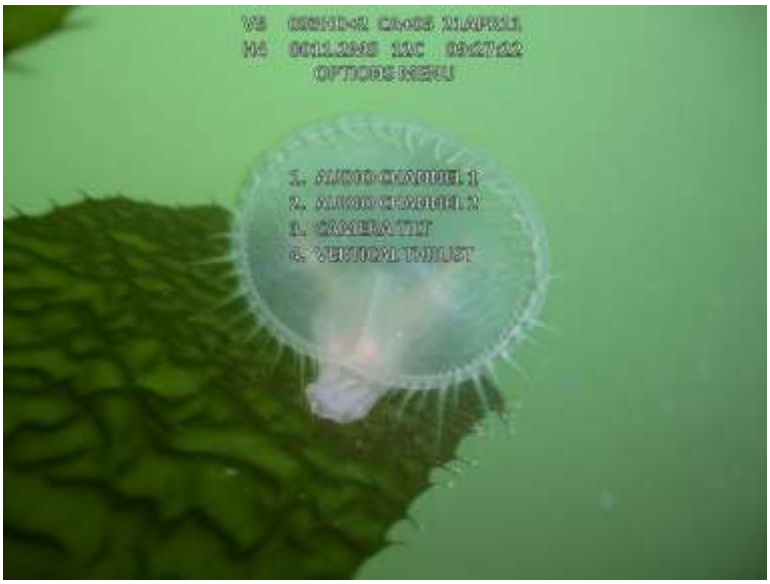


Once selected the system will display the temperature from the processor board in the electronics bottle of the vLBV.

When internal temp is being displayed, the overlay will display an asterisk to the left of the temperature.

Once the operator navigates away from this menu option, the display will return to the external temperature.

2.3.9 Options Menu



The Options Menu allows the operator to select and adjust the operation of four options for the vLBV.

1. **Audio Channel 1**
2. **Audio Channel 2**
3. **Camera Tilt**
4. **Vertical Thrust**

Selecting Audio Channel 1 or 2 gives the operator access to the input selection for the Audio Channels.

Once the operator has made a selection, an asterisk will display next to the activated selection.

At this time, the audio channels are not enabled.

Selecting Tilt Direction allows the operator to control the direction of the camera tilt function.

Normal is the default setting for the vLBV.

Normal
Down

Inverted
Up

Up

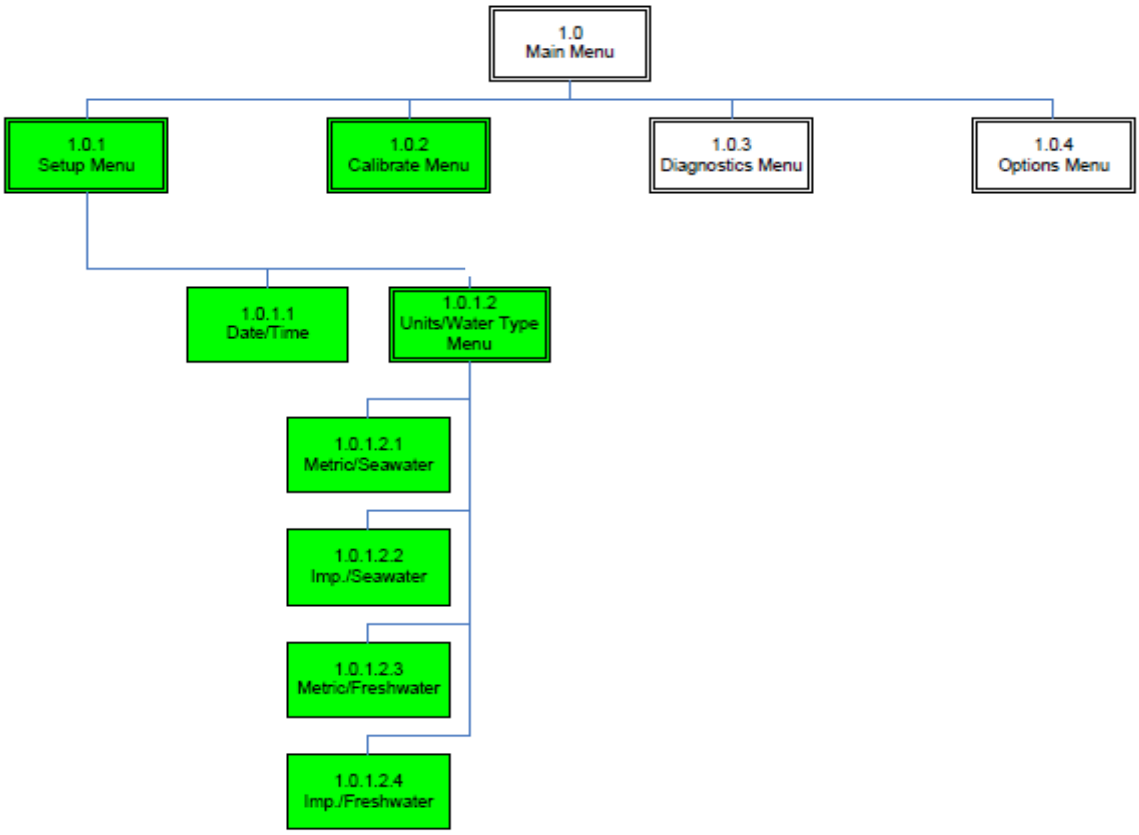
Down

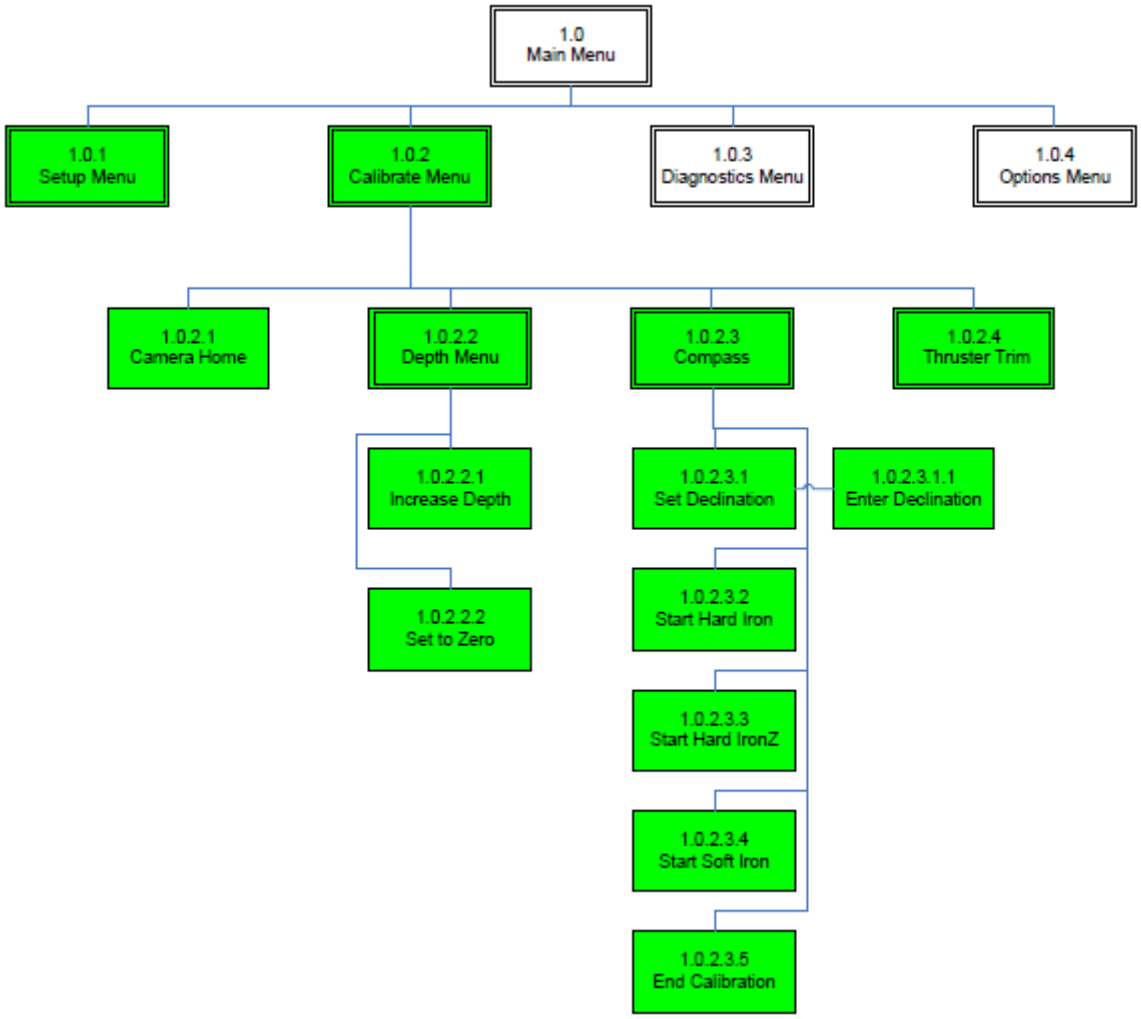
An asterisk will display to the right of the selection.

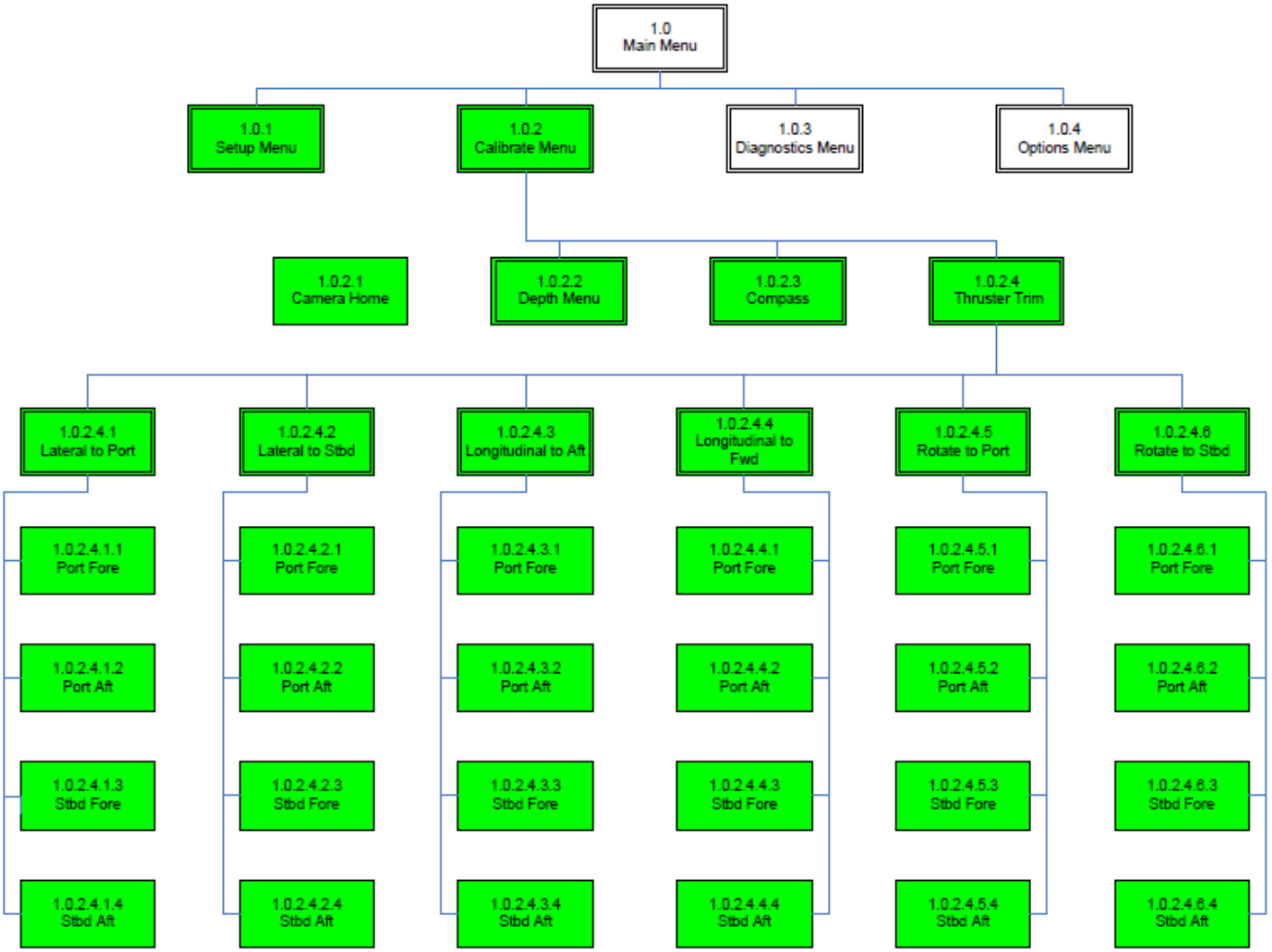
Vertical Direction allows the operator to set the dive/surface operation of the Vertical Thruster Control Knob on the left side of the Operator Control Unit.

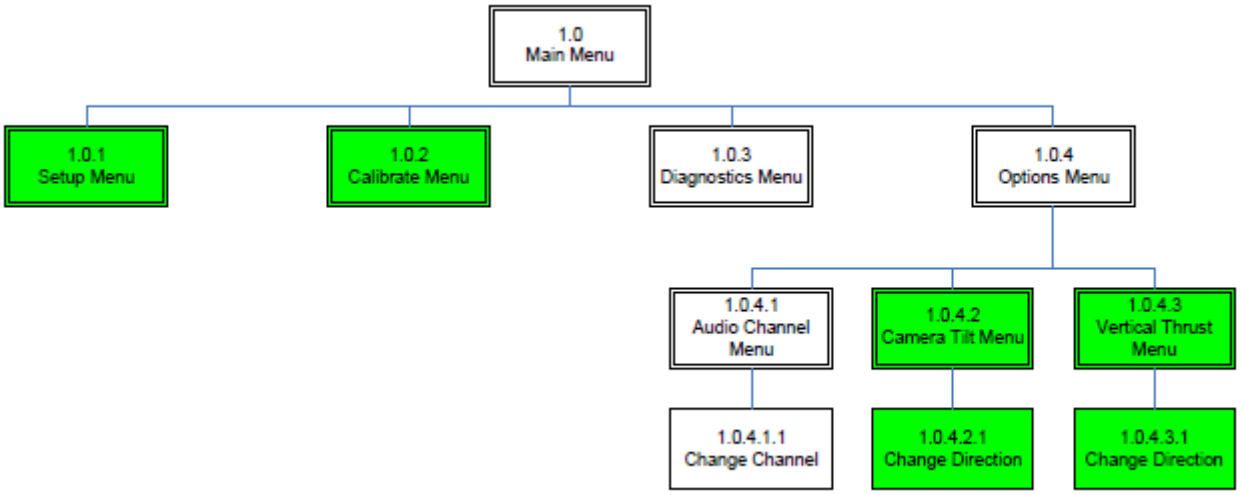
The default setting is rotate forward to surface.

2.4 Menu Tree


1.0
Main Menu
1.0.1
Setup Menu
1.0.2
Calibrate Menu
1.0.3
Diagnostics Menu
1.0.4
Options Menu
1.0.1.1
Date/Time
1.0.1.2
Units/Water Type
Menu
1.0.1.2.1
Metric/Seawater
1.0.1.2.2
Imp./Seawater
1.0.1.2.3
Metric/Freshwater
1.0.1.2.4
Imp./Freshwater


1.0
Main Menu
1.0.1
Setup Menu
1.0.2
Calibrate Menu
1.0.3
Diagnostics Menu
1.0.4
Options Menu
1.0.2.1
Camera Home
1.0.2.2
Depth Menu
1.0.2.3
Compass
1.0.2.4
Thruster Trim
1.0.2.2.1
Increase Depth
1.0.2.2.2
Set to Zero
1.0.2.3.1
Set Declination
1.0.2.3.1.1
Enter Declination
1.0.2.3.2
Start Hard Iron
1.0.2.3.3
Start Hard IronZ
1.0.2.3.4
Start Soft Iron
1.0.2.3.5
End Calibration


1.0
Main Menu
1.0.1
Setup Menu
1.0.2
Calibrate Menu
1.0.3
Diagnostics Menu
1.0.4
Options Menu
1.0.2.1
Camera Home
1.0.2.2
Depth Menu
1.0.2.3
Compass
1.0.2.4
Thruster Trim
1.0.2.4.1
Lateral to Port
1.0.2.4.2
Lateral to Stbd
1.0.2.4.3
Longitudinal to Aft
1.0.2.4.4
Longitudinal to Fwd
1.0.2.4.5
Rotate to Port
1.0.2.4.6
Rotate to Stbd
1.0.2.4.1.1
Port Fore
1.0.2.4.1.2
Port Aft
1.0.2.4.1.3
Stbd Fore
1.0.2.4.1.4
Stbd Aft
1.0.2.4.2.1
Port Fore
1.0.2.4.2.2
Port Aft
1.0.2.4.2.3
Stbd Fore
1.0.2.4.2.4
Stbd Aft
1.0.2.4.3.1
Port Fore
1.0.2.4.3.2
Port Aft
1.0.2.4.3.3
Stbd Fore
1.0.2.4.3.4
Stbd Aft
1.0.2.4.4.1
Port Fore
1.0.2.4.4.2
Port Aft
1.0.2.4.4.3
Stbd Fore
1.0.2.4.4.4
Stbd Aft
1.0.2.4.5.1
Port Fore
1.0.2.4.5.2
Port Aft
1.0.2.4.5.3
Stbd Fore
1.0.2.4.5.4
Stbd Aft
1.0.2.4.6.1
Port Fore
1.0.2.4.6.2
Port Aft
1.0.2.4.6.3
Stbd Fore
1.0.2.4.6.4
Stbd Aft
1.0
Main Menu
1.0.1
Setup Menu
1.0.2
Calibrate Menu
1.0.3
Diagnostics Menu
1.0.4
Options Menu
1.0.3.1
System Menu
1.0.3.2
Software Version
1.0.3.3
Hours Run
1.0.3.4
Display Int./Ext. Temp
1.0.3.1.1
Thruster Motors Menu
1.0.3.1.2
Light Menu
1.0.3.1.1.1
Port Fore
1.0.3.1.1.2
Port Aft
1.0.3.1.1.3
Port Vertical
1.0.3.1.1.4
Stbd Fore
1.0.3.1.1.5
Stbd Aft
1.0.3.1.1.6
Stbd Vertical


1.0
Main Menu
1.0.1
Setup Menu
1.0.2
Calibrate Menu
1.0.3
Diagnostics Menu
1.0.4
Options Menu
1.0.4.1
Audio Channel
Menu
1.0.4.2
Camera Tilt Menu
1.0.4.3
Vertical Thrust
Menu
1.0.4.1.1
Change Channel
1.0.4.2.1
Change Direction
1.0.4.3.1
Change Direction

Section 3 Operating the vLBV

Operation of the vLBV was designed to be simple and intuitive. Operator controls were consolidated to simplify the controller design, and ease operation.

The joystick controls horizontal movement and the vertical thruster control knob controls vertical movement. Camera controls were positioned so that the left hand can quickly move from the vertical thruster control knob and back. The majority of operator input will be for the horizontal thrusters, so even the accessory controls were designed to be operated with the left hand.

To surface or dive the vLBV, rotate the vertical thruster control knob in the desired direction.

To drive the vLBV, move the joystick in the desired direction of travel.

To turn the vehicle, rotate the knob at the top of the joystick in the direction required.

Remember that all thruster controls are proportional, the further the control is moved, the faster the vLBV moves on that axis.

The inclusion of Auto features such as Depth, Heading and Trim allow the operator to select these features and monitor the video, taking control of the vehicle only as needed.

3.1 Operating Environment

When possible, a quiet, traffic free operating environment allows the pilot to concentrate on the task at hand while minimizing distractions.

If it is necessary to operate in an area with spectators, a simple boundary will suffice to keep distractions to a minimum. In this type of environment, consider adding one additional individual whose task is to prevent interference by fielding questions and running interference.

Set up the equipment in a fashion that maximizes comfort. This can be done by utilizing the transit cases for the equipment. The ICC/INC can be set on top of the vLBV transit case and the transit case for the URS can serve as the seat for the operator. This places the equipment at an optimal height for comfort and ease of control. The SPS30XX can be set on edge just off to the side.

3.2 Deployment

Deploying the system can be as simple as placing it in the water. There are steps that can be taken in the planning and setup phase to ease operation and improve the potential for success.

1. **Knowledge of the area of operation**: A little research beforehand increases the knowledge of the operating area, improving the pilots' opportunities for success. Knowing the area and the potential risks allows the pilot to plan his operation to avoid the risks. Attempting operations without a plan increases the risk of damage or loss.

2. **Plan the operation and follow the plan**: It is common for circumstances underwater to be significantly different than what was planned for. When this arises, it is a best practice to surface the vLBV or stop operations until a new plan is devised. Attempting to charge forward without an updated plan will significantly increase the risk of damage or loss.

3. **Setting up the equipment**: It is best practice to set the equipment up facing the work area. If deploying off the starboard side of a vessel, orienting the monitor and hand controller so that the operator is facing to starboard eases the operator's sense of direction in relation to the deployment platform. While this is not a critical consideration, it should not be overlooked when setting up the system.

4. **Geographic reference**: The compass data output from the vLBV is a numeric value from 0-360 degrees. As humans we reference everything we do to our own orientation, as with item 3 above, the operator normally needs to know what direction he or she is facing in order to calculate the direction the vLBV is going. A simple method to help do this is to include a small magnetic compass as part of your setup. Doing this allows the pilot to look down at the compass and quickly determine the direction of vLBV travel at a glance.

3.3 Tether

Proper control of the tether is an important part of vehicle operations.

Do not deploy excess tether: Only use what is necessary to complete the job. Deploying too much tether places the vLBV and the tether at risk of damage. By only having the amount of tether in the water required for the free movement of the vLBV, the risk of entanglement is reduced and the risk of damage to the fiber line inside the tether is also reduced.

Active tether management is one of the key components to successful operation. A dedicated tether manager, that deploys tether as the operator drives away, and recovers tether recovering as the operator returns is very useful. While this will not prevent entanglement, it significantly reduces the risk.

When operating in areas of high current, active tether management will also make the vLBV easier to operate. Reducing the amount of tether surface area exposed to the current reduces the effect of the current on the vLBV.

Another technique useful in high current areas is a system utilizing a clump weight attached to the tether to hold it straight up and down in the water column, with free tether below that to allow

operation of the vLBV. Experience has shown that this should be limited to less than 30 meters of free tether below the clump weight. Delivered as part of your basic spares kit is a piece of hose designed to slip over the tether and provide an attaching point for the depressor weight. Along with this is the SeaBotix DOCS-038 Manual Clump Weight System Instructions. This information is also included on the CD of documentation delivered with your system.

3.4 Piloting

While anyone can operate a vLBV, piloting is a skill developed over time.

It is normal for each pilot to develop a particular skill set at which they excel. This should be taken into account when assigning tasks.

As discussed in the next segment, practice is the key to developing piloting skill.

3.5 Practice

As with many skills: practice, practice, practice.

When possible, practice in a pool or a confined body of water with few obstacles or entanglement hazards. This will give the operator experience on the controls, while reducing the added issues of dealing with current or poor visibility. As the operator gains familiarity with the controls and the response from the vLBV, training scenarios can be added to simulate the tasks required.

Objects can be added for training using the optional manipulator, optional sonar's, and other sensors.

Once the operator is comfortable operating the system and the accessories, move to open water training. Slowly increase the complexity and task loading.

While time consuming, following this type of training regimen will pay dividends during operational use.

3.5.1 Watching the vLBV

During the initial phases of learning to operate the vLBV, it is can be helpful to directly observe the vehicle while controlling it. This allows the operator to quickly get a feel for how the vLBV reacts to controls.

However, when the vLBV is pointed back in the operators' direction, the controls will react as they should, but the operators' perspective is reversed. What will happen is that the target will be to the right of the vLBV, but the operator will see it to the left, and turn in the incorrect direction.

When flying to a distant inspection point, most operators find it easier to fly to the location with the vLBV on the surface, and descend once the target is in sight. In this case direct observation of the vLBV can be beneficial.

3.5.2 Watching the Monitor

Learn to control the vLBV at all times while watching the video from the vehicle: Try not to look at the vLBV. This develops intuitive control of the vLBV.

If your target slides off the monitor to the left, the operator need only turn the top of the joystick to the left to re-acquire the target visually.

Once the vLBV is at depth, this is the only way to control the vehicle.

3.6 Controlling the vLBV

Proper hand placement when holding the OCU (Operator Control Unit) reduces operator fatigue and makes piloting easier. Proper hand placement is both hands on the controller, with the thumb and forefinger from each hand on the thruster controls. Take the joystick controls with your Right hand, and use your left hand on the vertical thruster control knob as shown.

Use smooth movement of the joystick. A jerky motion with the joystick will result in the vLBV duplicating those actions underwater, making the video difficult to view and interpret.

When changing the direction of the vLBV, it is a best practice to turn while driving forward. If you stop, turn then move, during the period that the vLBV has no forward motion, water movement will dictate where the vLBV is going, not the operator.

3.7 Thruster Gain Controls

There are two (2) settings for thruster gain controls incorporated into the vLBV; Vertical and Horizontal.

There are ten (10) steps from 10% to 100%, and the steps are referred to as Gains 1-0. Gain 1 is the lowest, and Gain 0 is the highest. These steps effect the maximum RPM that the thruster motors will operate at with a given joystick or vertical thruster control knob input. Thruster RPM equates to speed, higher thruster RPM=faster, lower=slower.

Lower gain settings allow the operator greater precision when positioning the vLBV for either video, or when attempting to recover an object using the optional manipulator.

Higher gain settings are useful when operating in current, or piloting the vLBV to a search area located some distance from the deployment site.

Refer to Section 2.1.9 for specifics on changing the gain settings.

3.8 vLBV Trim Adjustments

Trim Adjustments refers to the physical adjustment of the vLBV for neutral buoyancy. This is accomplished by adding floatation or weight to the vLBV to achieve neutral buoyancy, and a level trim, fore and aft, side to side. Three factors affect the trim: Salinity, Temperature and Depth. Of these, the salinity has the greatest effect. A change in salinity of just 2 parts per thousand will change the trim by as much as 50 grams. Temperature will change the buoyancy by about 1 gram per degree, and its effect is negligible. In the designed operating range for the vLBV, the effect of depth on buoyancy will primarily be an issue with the tether. As the tether compresses, it will decrease its displacement reducing the buoyancy.

Experience demonstrates that operation of the system is significantly enhanced when the system is properly trimmed.

When trimmed too light, or too heavy, the operator expends effort holding depth, rather than simply concentrating on the task.

As delivered from the factory your system was trimmed per the sales order for either fresh water or salt water. At our facility, the water is about 19C when we set the trim. Your specific operating area may have colder, or warmer water and or different salinity.

To adjust the trim, place the vLBV in a container of water of the salinity and temperature where it will be operated. Add or remove weights till the system sits just at the water surface, and is level fore and aft, side to side. The bumper frames for the vLBV should just break the surface of the water. If optional top mounted sensors are included, the trim point moves up to the upper surface of the sensor.

3.9 Considerations When Using the Auto Functions

The auto functions incorporated into the controls for the vLBV were specifically designed to ease operation, and reduce operator overload during inspections.

3.9.1 Auto Depth

This function does exactly what its name implies. The operator sets the vLBV at a desired depth, and selects the AUTO DEPTH function.

The software will then take control of the vertical thrusters to hold the vLBV at the set depth.

Operation of the Vertical Thruster Control Knob will override the auto setting until it is returned to the neutral position.

An example of use of the AUTO DEPTH function; during a bottom survey, the operator is required to maintain a 2 meter HOB (Height over Bottom.) At the beginning of the flight, the operator flies the vLBV to the bottom, makes a depth reading, and then using the vertical thruster control knob, moves the vLBV 2 meter up from the bottom, then selects Auto Depth after the vLBV is stable at the new depth. The operator need now only concentrate on maintaining course and speed to provide the best video image, and the processor board and software will maintain the depth.

3.9.2 Auto Heading

This function also does exactly what its name implies. The operator sets the vLBV on a desired course, and selects the AUTO HEAD function.

The software will then take control of the horizontal thrusters to hold the vLBV at the set heading.

Operation of the direction knob at the top of the joystick will override the Auto function, but the vLBV will return to the set heading once the operator releases the controls.

An example for use of AUTO HEAD function; the deployment site is located at a distance from the survey site. The operator sets the vLBV on a heading required to get to the survey site. The operator selects Auto Heading, for course keeping, and then drives the vLBV forward to the location. Remember, water is rarely static, so course corrections are required to accommodate for set and drift caused by the currents acting upon the vLBV and the tether.

3.9.3 Auto Trim

The TRIM function refers to speed settings for all thrusters. When the TRIM function is engaged, the software locks all thrusters at their current speed setting. This is not to be confused with the GAIN settings. If the operator is thrusting forward at 50% throttle, the TRIM function will keep the thrusters running at that RPM once the operator releases the joystick. As with the other Auto functions, the operator can override the TRIM function by simply operating the appropriate control, joystick or vertical thruster control knob.

Section 4 Maintenance

The vLBV was designed to keep routine operator maintenance to a minimum.

The basic concept is that the operator will clean the exterior of the vLBV with fresh water after each operation. The operator will then dry the vehicle and stow it in preparation for its next deployment.

4.1 After Each Use

After retrieving the vLBV, it is the operator should immerse the system in a container of fresh water, run the thrusters for a period of about 2 minutes at low speed to rinse any salt, mud or other contaminants from the exterior of the system. Utilization of this method ensures the best clean possible.

If you are not able to do this, then use a hose with a low velocity spray nozzle to rinse the vLBV top and bottom. The vLBV can be stood on its rear to facilitate rinsing the underside.

When possible, allow the system to air dry prior to stowing in the provided transit case. Low pressure air and clean dry towels can be substituted to speed the drying process.

4.1.1 After Each Use (Dirty Water Conditions)

When the system is operated in dirty water environments with high sediment loads or significant biological activity or the presence of drifting debris, the cleaning process will need to be more involved.

First visually inspect the propeller guards for fouling. Any material sticking out from under the dome of a propeller requires the removal of both the propeller and the propeller guard, to remove the fouling. With material under the shroud of the propeller, the potential for the material to be ingested into the shaft seals of the propeller is increased.

To remove the propeller, remove the 2 ea 6 mm radio pattern nuts, and pull the propeller off of the collet.

Remove any debris from underneath the propeller hub and re-install.

4.2 After Every 50 Hours

After every 50 hours of operational use, we recommend re-lubricating the propeller shaft seal on each of the thrusters.

This procedure should also be performed if the system has been stored for 6 months or more.

In the menu selection for the vehicle, there is a counter that records and will display hours run. Refer to Section 2.5.2.3 for instructions on how to access this information.

The materials required for this procedure are:

1. # 2 Phillips screwdriver (SeaBotix P/N TO015)
2. Shaft Seal Lubricant (SeaBotix P/N GLA003)

NOTICE

DO NOT substitute lubricant. Use of any lubricant other than that specified by SeaBotix may damage the shaft seals and will affect the warranty.

Time required to perform this procedure is approximately 20 minutes.

1.

Place the vLBV on a flat stable surface.

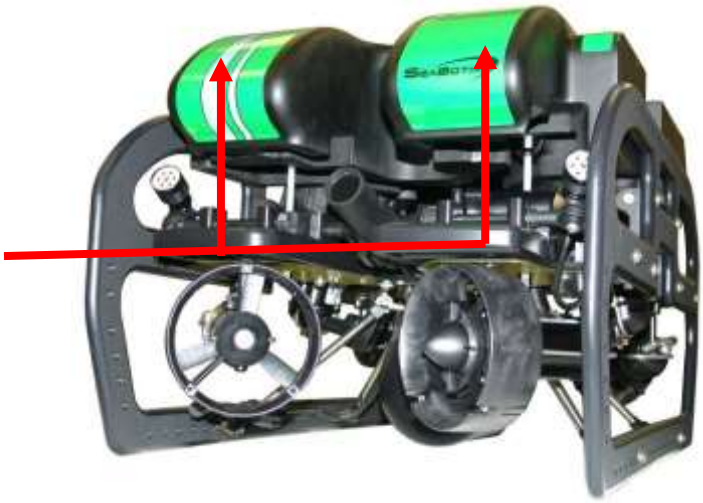
2.

Remove the four 8mm nylon wing nuts securing the floatation module to the vLBV

NOTE: It will be necessary to remove any floatation mounted sensors prior to removal of the float.

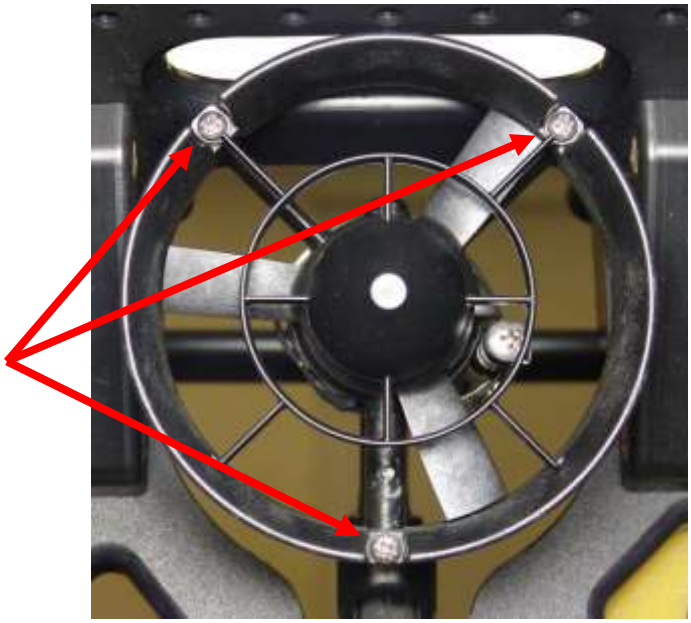
3.

Lift the floatation module straight up and off of the vehicle.



4.

Using a #2 Phillips screwdriver remove the three Phillips pan head screws securing the propeller nozzle to the two vertical thrusters.

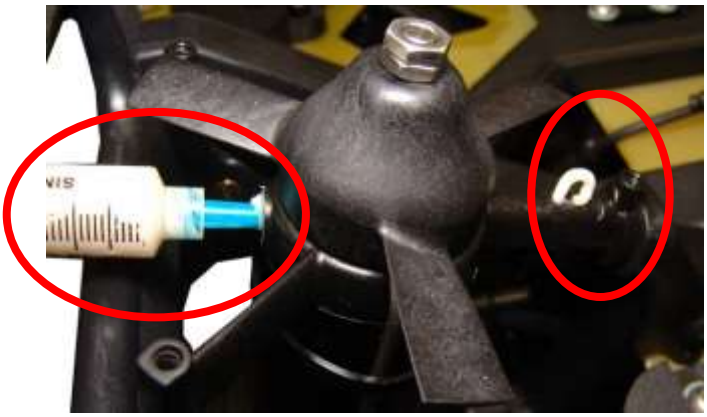


5.

Remove the black nylon Phillips pan head screw from the propeller end cap to gain access to the grease galley for both vertical thrusters.

6.

Insert the tip of the syringe provided (GLA003) and inject lubricant until it comes out of the weep hole located on the propeller side of the propeller end cap.



7.

Top off the injection hole with lubricant to prevent air voids and re-install the nylon screw.

8.

Clean off excess lubricant.

9.

Verify proper tightness on all thruster mounting screws including the vertical thruster elbows. (23 Fasteners total.)

3 ea for the horizontal thrusters

5 ea for the vertical thrusters.

9.

Re-install the propeller nozzle.

10.

Re-install the floatation module and the four securing wing nuts.

11.

Place the vLBV on its top and remove the propeller nozzles from the 4 thrusters located on the bottom of the vLBV.

12.

Repeat steps 5-9 for the four horizontal thrusters.

13.

Connect and test system for proper operation.

Use Section 1.4 of this manual.

4.3 After 500 Hours

After 500 hours of use or 5 years, whichever comes first, we recommend replacing all of the seals on the vLBV.

4.4 Long Term

During the performance of the 50 hour and the 500 hour maintenance, the technician should visually inspect all metal exterior components and fasteners for signs of corrosion.

A faulty cable or component can allow a low voltage signal to short into the water causing corrosion to start.

The location and severity of corrosion may require replacement of the damaged part.

4.5 Repairs

All repairs should be carried out by SeaBotix trained technicians.

SeaBotix offers both in-house and field training courses to support the operator.

The maintenance manual offers step-by-step instructions describing disassembly, replacement and reassembly of the vehicle components. Anyone with moderate mechanical skill will be able complete the repairs when the instructions are followed exactly as written.

For further assistance please contact service@seabotix.com or call +1 619 450 4000 extension 124.

4.6 Software Upgrades

From time to time, SeaBotix may issue software upgrades to improve system performance, or to upgrade system capabilities.

For the latest revision of the operating software, please visit our website.
http://www.seabotix.com/service_support/software_update.htm

Section 5 Fault Isolation

Fault isolation for the vLBV requires knowledge of system power, interconnect, and operation.

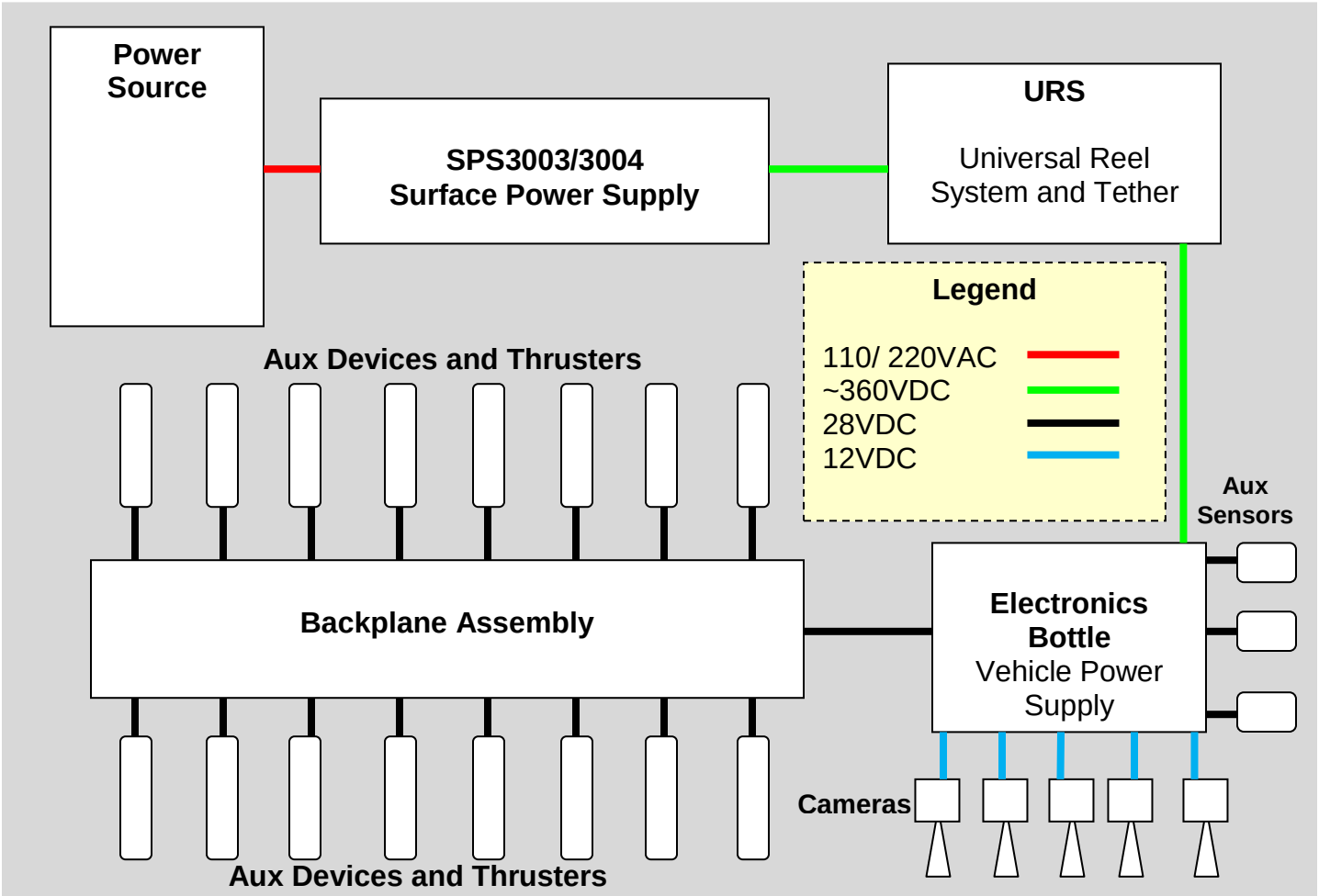
The basic system components can be broken down into three portions. They are listed in priority:

1. Power
2. Control
3. Video

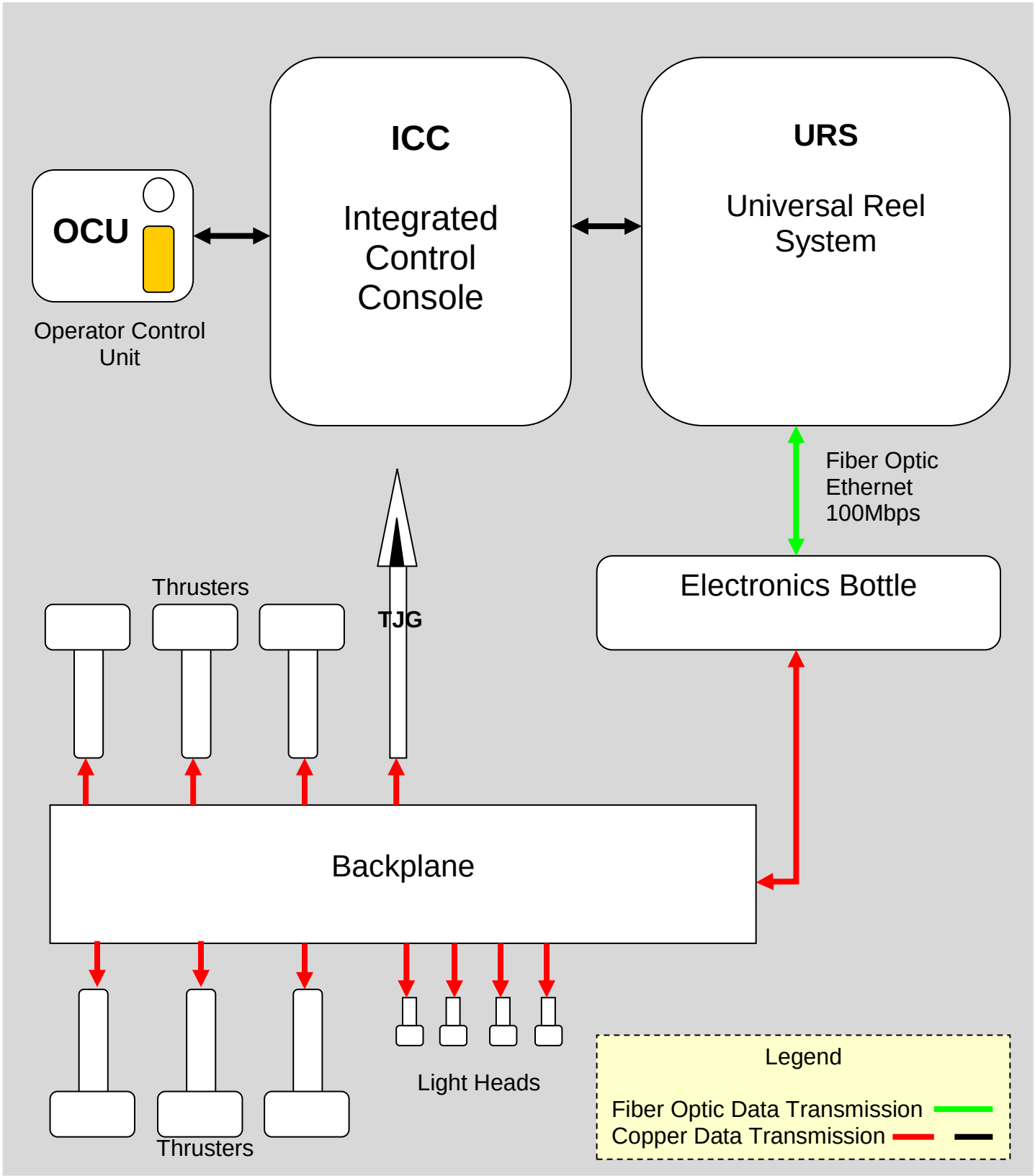
The technician/operator must first determine where the base fault is, and resolve issues in sequence:

Resolve power issues before addressing control issues. Resolve control issues before addressing video issues

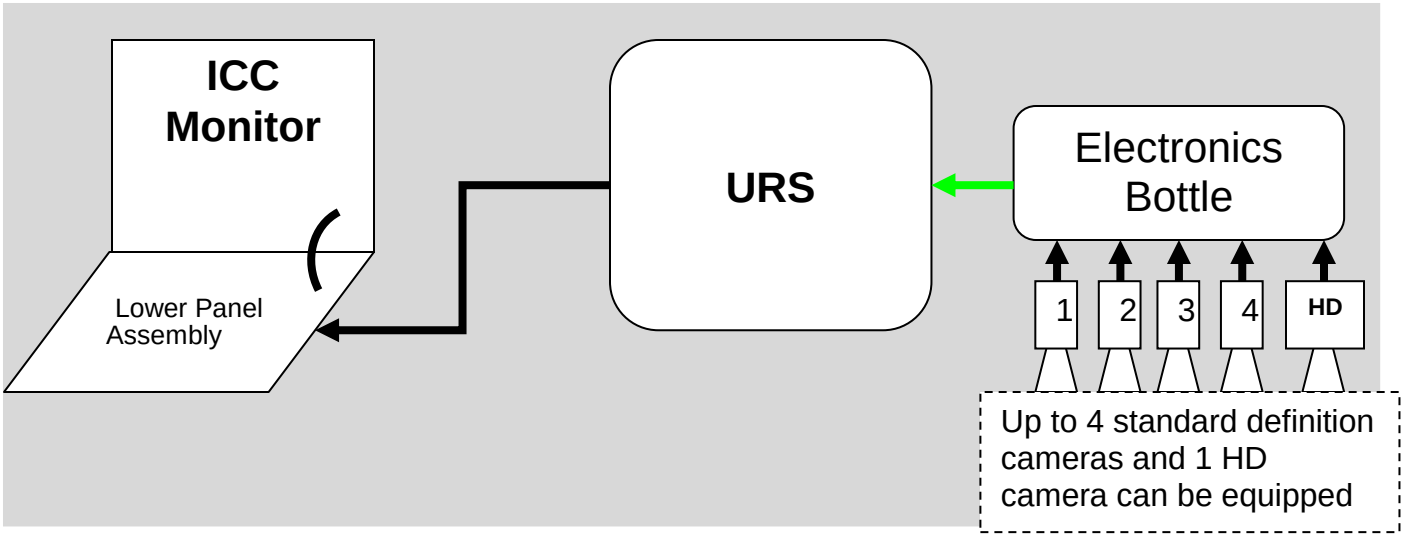
5.1. Basic Power Block Diagram



5.2 Basic Communications Block Diagram



5.3 Basic Block Diagram Video



Video is routed into the lower panel of the ICC/INC through a video distribution board, where it is routed to a video out connection and to the monitor.

5.4 Theory of Operation

Control of the vLBV starts and ends at the Operator Control Unit (OCU). The operator generates a command via the joystick, vertical thruster control knob, or keypad. The data is transmitted to the Sensor Nav Board and is converted from RS-232 to Ethernet for transmission to the vLBV via the tether.

The data transmission to and from the vLBV is over a 100MB Ethernet fiber optic line inside the tether.

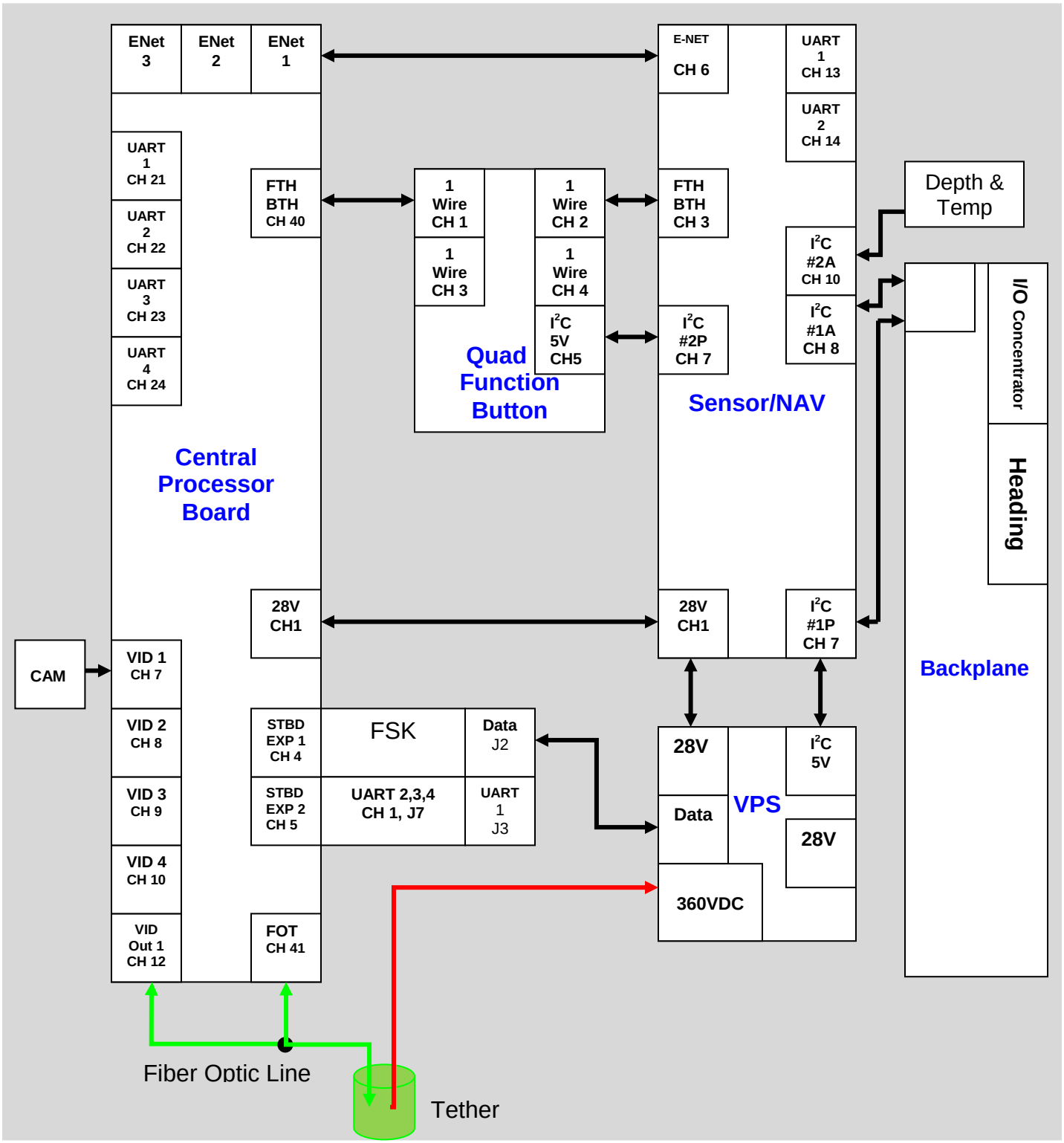
Once the data transmission is received at the Electronics Bottle Assembly on the bottom side of the vLBV, the Ethernet data is converted back to electrical RS232 data. It then is transmitted to the Central Processor Board for routing to the specified device.

The Central Processor Board sends a response back to the OCU to acknowledge the command. This allows the system to verify that commands are received.

The Central Processor Board passes the operational command to the Power Supply Interface Board for routing to backplane mounted devices such as lights, thrusters, or auxiliary devices like the Three Jaw Grabber.

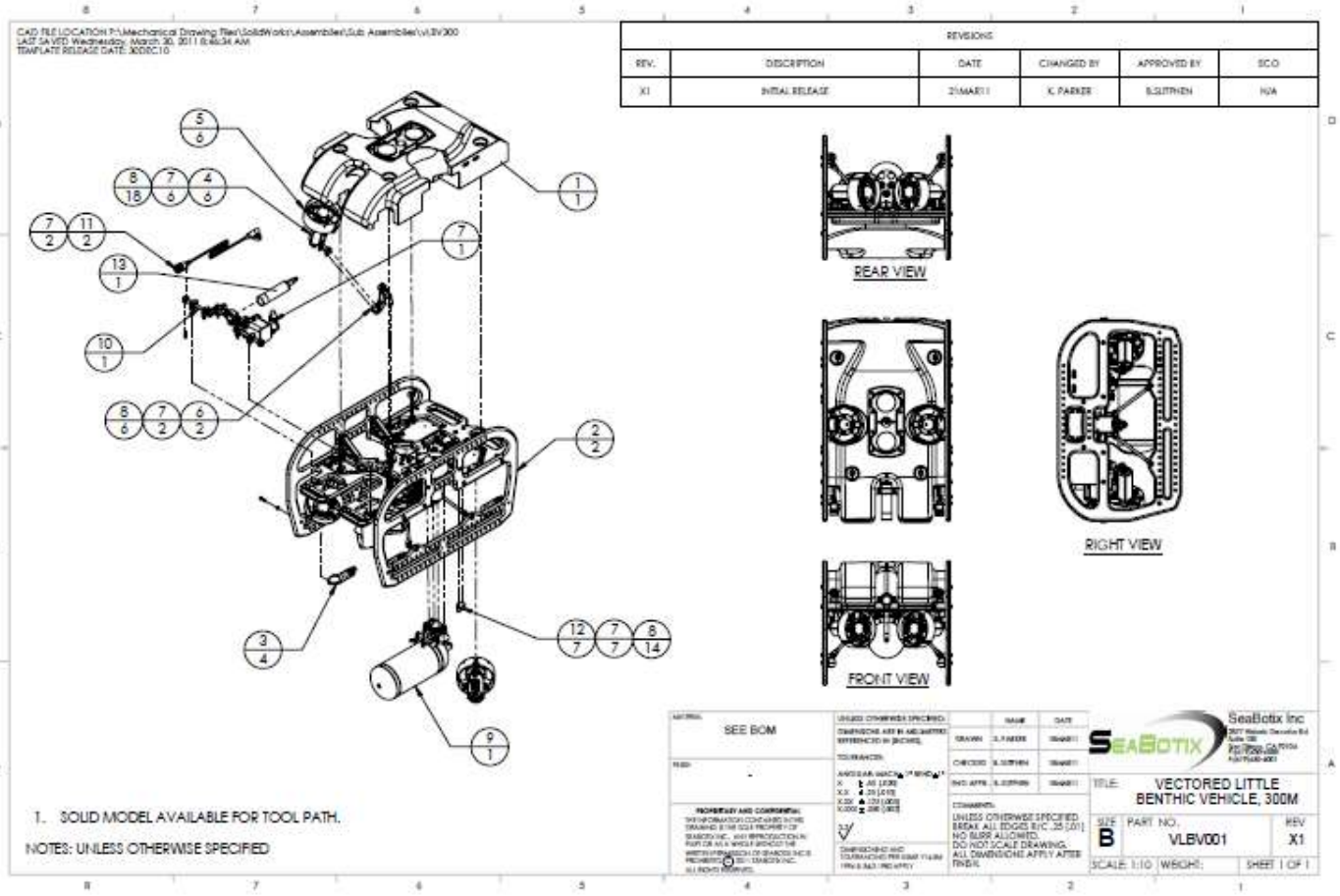
Thrusters, lights and auxiliary devices are controlled using I^2C data protocols. On power up, the system polls each of these devices to populate a table allowing the Central Processor to communicate and control them.

5.5 Functional Block Diagram vLBV



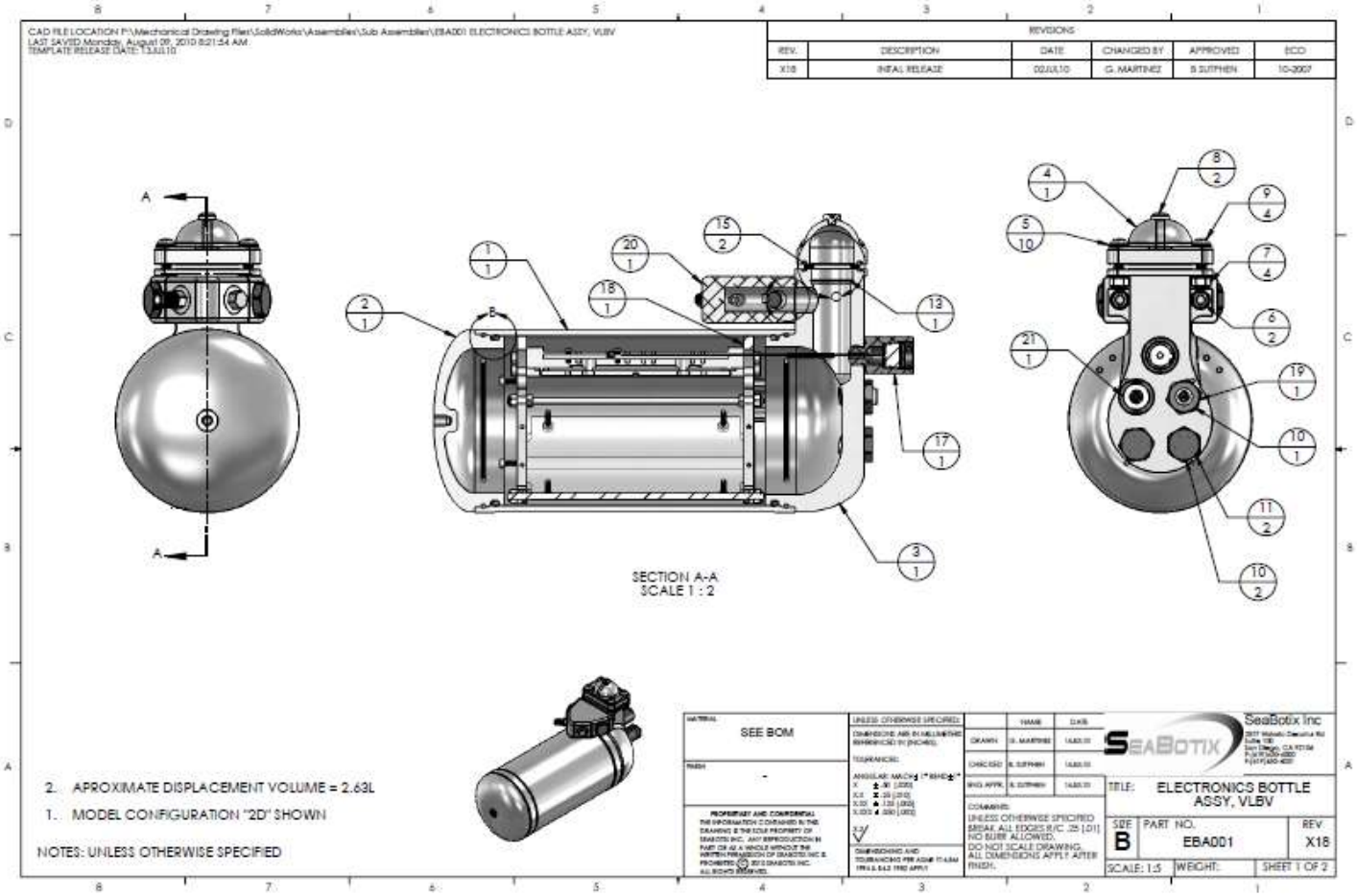
Section 6 Exploded Diagrams and Parts Lists

6.1 vLBV


REVISIONS
REV. DESCRIPTION DATE CHANGED BY APPROVED BY ECO
X1 INITIAL RELEASE 21MAR11 K. PARKER B.SLITHEN N/A
REAR VIEW
RIGHT VIEW
FRONT VIEW
SEE BOM
SeaBotix Inc
TITLE: VECTORED LITTLE BENTHIC VEHICLE, 300M
SIZE B PART NO. VLBV001 REV X1
SCALE: 1:10 WEIGHT: SHEET 1 OF 1
1. SOLID MODEL AVAILABLE FOR TOOL PATH.
NOTES: UNLESS OTHERWISE SPECIFIED

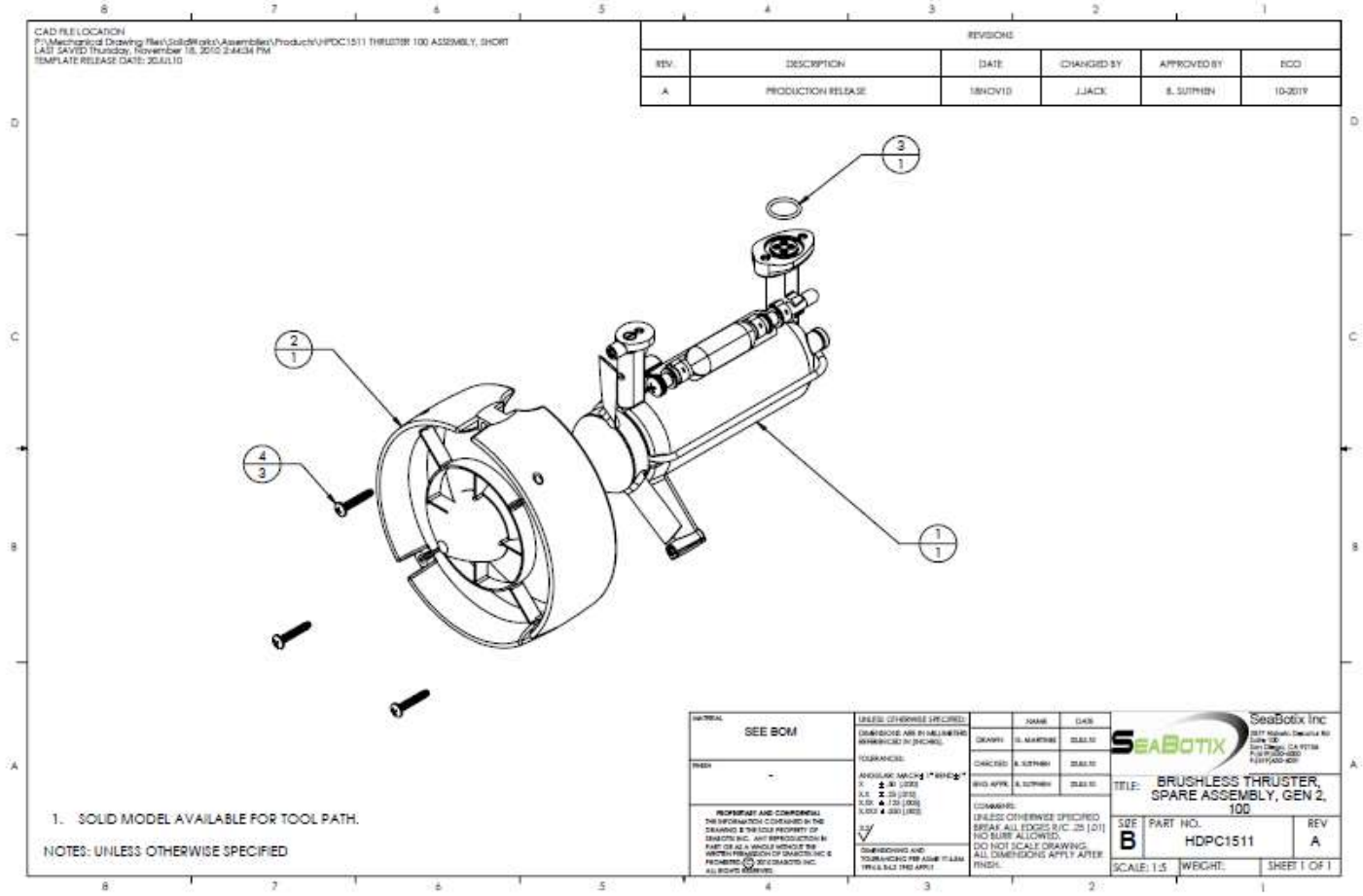
Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			VLBV001	A		Vectored Little Benthic Vehicl		1.00000	EA
1	Asm	1	.FLA001	C		Float Assy, 300M, vLBV	1.00000000	1.00000	EA
1	Asm	2	.FRA002	A		Frame Assembly, 390, vLBV	2.00000000	2.00000	EA
1	Asm	3	.BTA001	A		Ballast Assembly, Tungsten	4.00000000	4.00000	EA
1	Asm	4	.BLA1510	B		Brushless Thruster 100 Assembl	6.00000000	6.00000	EA
1	Asm	5	.SKA001	A		Kort Nozzle Assy, 100	6.00000000	6.00000	EA
1	Mtl	6	.VBA1501	A		Assembly, Vertical Thruster El	2.00000000	2.00000	EA
1	Mtl	7	.SL304			O-Ring, 2-014, Buna-N, 70D, Co	18.00000000	18.00000	EA
1	Mtl	8	.FN903			Screw, Plastite, #6 x 1/2", 18	38.00000000	38.00000	EA
1	Asm	9	EBA001	A		Electronics Bottle Assembly, v	1.00000000	1.00000	EA
1	Asm	10	.TLM001	A		Tilt Mechanism, vLBV	1.00000000	1.00000	EA
1	Asm	11	.ELS1094	B		Assy, External Lighting System	2.00000000	2.00000	EA
1	Mtl	12	.MA945	A		Plug, Auxiliary Blank, Modifie	7.00000000	7.00000	EA
1	Asm	13	.VI340	A		Camera, Color with Hummer Conn	1.00000000	1.00000	EA
1	Mtl	100	.LB762	A		Label Set, Vehicle Float, vLBV	1.00000000	1.00000	EA
1	Mtl	110	.CBA764	A		vLBV Video Camera Cable Assemb	1.00000000	1.00000	EA
1	Asm	120	.PCT113-000	A		PCT, IO Concentrator, NT, 16x	1.00000000	1.00000	EA
1	Asm	130	.PCT118-000	A		PCT, Compass Interface # 1	1.00000000	1.00000	EA
1	Mtl	140	.EC1366			OS4000-T Nano Compass Board	1.00000000	1.00000	EA

6.1.1 Electronics Bottle



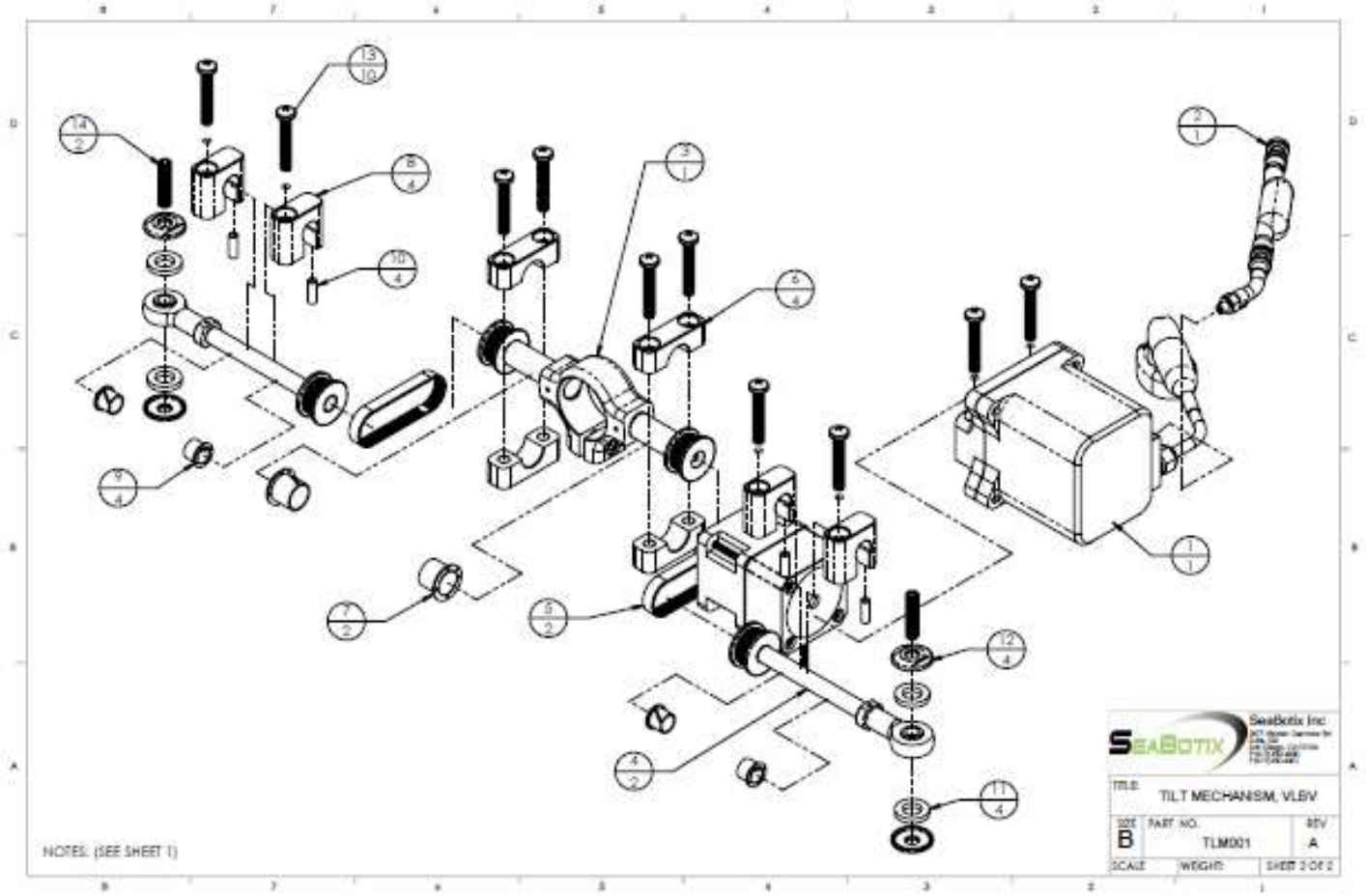
Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			EBA001	A		Electronics Bottle Assembly, v		1.00000	EA
1	Mtl	1	.MA1086	A		Tube, Electronics Bottle, vLBV	1.00000000	1.00000	EA
1	Mtl	2	.MA1084	A		End Cap, Closed, Electronics B	1.00000000	1.00000	EA
1	Mtl	3	.MA1085	C		End Cap, Open, Electronics Bot	1.00000000	1.00000	EA
1	Mtl	4	.MA1121	A		End Cap, Oblong, vLBV	1.00000000	1.00000	EA
1	Mtl	5	.FN833			Washer, M6, Flat, 316SS	10.00000000	10.00000	EA
1	Mtl	6	.FN860			Screw, M6-1.0 x 10, SHCS-SK, 3	2.00000000	2.00000	EA
1	Mtl	7	.FN323			Nut, M6, Nyloc	4.00000000	4.00000	EA
1	Mtl	8	.FN313			Screw, 10-32 x 3/8", Silicone	2.00000000	2.00000	EA
1	Mtl	9	.FN388			Screw, M6 x 25, Button Head	4.00000000	4.00000	EA
1	Mtl	10	.SL304			O-Ring, 2-014, Buna-N, 70D, Co	3.00000000	3.00000	EA
1	Mtl	11	.MA314	G		Plug, Camera Housing	2.00000000	2.00000	EA
1	Mtl	12	.FN559			Retaining Ring, Motor Housing	0.67000000	0.67000	MT
1	Mtl	13	.HW021			Retaining Ring, 25mm Bore	1.00000000	1.00000	EA
1	Mtl	14	.SL923			Seal, O-Ring, Buna-N, AS568A-2	2.00000000	2.00000	EA
1	Mtl	15	.SL107			O-Ring, 1-1/2"OD, 1-3/8"ID, Bu	2.00000000	2.00000	EA
1	Mtl	16	.SL921			Seal, O-ring, Buna-N, AS568A-0	1.00000000	1.00000	EA
1	Asm	17	.DTA1000	A		Depth & Temp Sensor Assy., 100	1.00000000	1.00000	EA
1	Asm	18	.ERA001	B		Electronics Rack Assembly	1.00000000	1.00000	EA
1	Mtl	19	.MA302	D		Housing, Vacuum Fitting	1.00000000	1.00000	EA
1	Asm	20	.MAN002	A		Manifold, Input-Output, 4 Port	1.00000000	1.00000	EA
1	Asm	21	.FIA1501	A		Fiber Interconnect, FO Assembl	1.00000000	1.00000	EA
1	Asm	30	.PCT117-000	A		PCT, Electronics Bottle Backpl	1.00000000	1.00000	EA
1	Mtl	40	.CN024			Connector, 3 Contact, Male, Bu	1.00000000	1.00000	EA
1	Mtl	50	.CN403			Locking Sleeve, Female	1.00000000	1.00000	EA

6.1.2 Thrusters

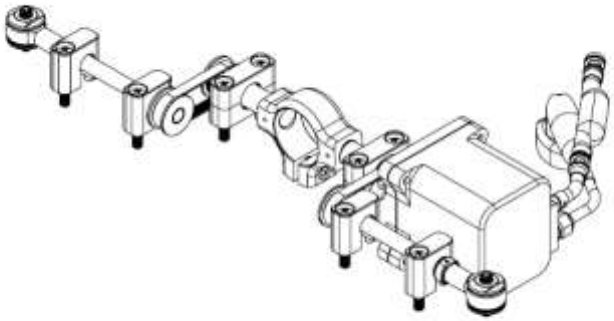


Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			BLA1510	B		Brushless Thruster 100 Assembl		1.00000	EA
1	Asm	1	.MO310	A		Motor, BLDC, Thruster, Electri	1.00000000	1.00000	EA
1	Mtl	2	.MA1072	A		Tube, Thruster, Short	1.00000000	1.00000	EA
1	Mtl	3	.SL329			Back-up Ring, Thruster Tube, 8	2.00000000	2.00000	EA
1	Mtl	4	.SL313			O-Ring, Thruster Tube, 2-029 B	2.00000000	2.00000	EA
1	Mtl	5	.MA561	D		Seal, Cartridge Retainer, Line	1.00000000	1.00000	EA
1	Mtl	6	.ML341	C		Seal, Double Cartridge	1.00000000	1.00000	EA
1	Mtl	7	.SL317			O-Ring, 2-106, Viton Quad Ring	2.00000000	2.00000	EA
1	Mtl	8	.SL315			O-Ring, Cartridge Retainer, 2-	1.00000000	1.00000	EA
1	Mtl	9	.FN044			Screw, #6 x 3/8", Phillips Fla	4.00000000	4.00000	EA
1	Mtl	10	.WP310	A		Bale, Thruster, Short	1.00000000	1.00000	EA
1	Mtl	11	.ML405	B		Propeller, 3 Blade, 100XL	1.00000000	1.00000	EA
1	Mtl	12	.FN902			Nut, M6 x1 x3.2, 316SS	2.00000000	2.00000	EA
1	Mtl	14	.MA1075	A		Collet, 4mm Bore, M6 Thread	1.00000000	1.00000	EA
1	Mtl	15	.MA1125	A		Pin, 5mm, Prop Collet	1.00000000	1.00000	EA
1	Asm	16	.OCA1503	A		Assembly, Oil Compensation Tub	1.00000000	1.00000	EA
1	Asm	18	.BLC1504	A		Brushless Thruster 100, Connec	1.00000000	1.00000	EA
1	Asm	19	.PCA045	A		Assy, PCT, Motor Controller Bo	1.00000000	1.00000	EA
1	Asm	20	.BGP1501	A		Brushless Thruster 100, Prop E	1.00000000	1.00000	EA
1	Mtl	21	.LB301	B		Label, Serial Number	1.00000000	1.00000	EA
1	Mtl	22	.FN101			Washer, Seal, Nylon	2.00000000	2.00000	EA
1	Mtl	23	.FN310			Screw, # 4 x 5/8", Thread Form	1.00000000	1.00000	EA
1	Mtl	24	.LU003	A		Oil, Mineral Lite	0.10000000	0.10000	LT
1	Mtl	25	.FN029			Screw, 10-32 x 1/8", Silicone	1.00000000	1.00000	EA
1	Mtl	100	.SS081			Syringe, 10cc	0.00000001	0.00000	EA

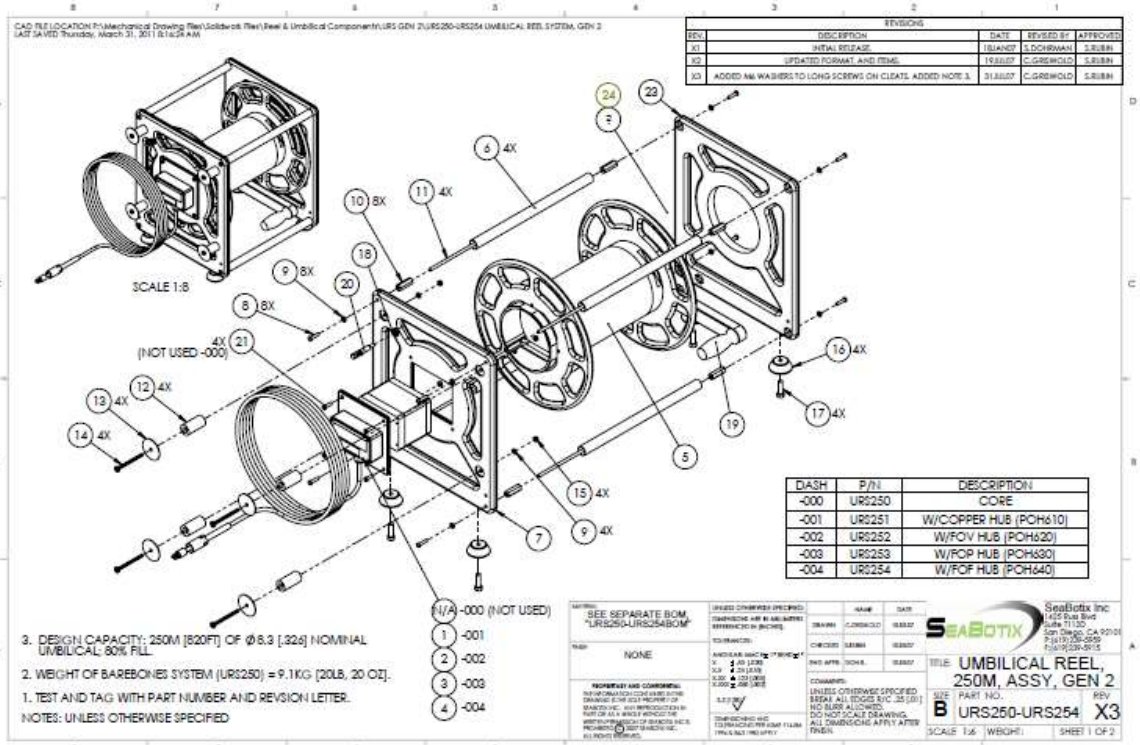
6.1.3 Tilt Mechanism



Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			TLM001	A		Tilt Mechanism, vLBV		1.00000	EA
1	Asm	1	.MHA002	C		Motor Housing, Tilt Assembly	1.00000000	1.00000	EA
1	Asm	2	.OCA1500	G		Assembly, Oil Compensation Tub	1.00000000	1.00000	EA
1	Asm	3	.DSC003	A		Drive Shaft Coupling, Camera A	1.00000000	1.00000	EA
1	Asm	4	.DSC002	A		Drive Shaft Coupling, Light Ax	2.00000000	2.00000	EA
1	Mtl	5	.ML803			Timing Belt, 2.03 Pitch, 64 Gr	2.00000000	2.00000	EA
1	Mtl	6	.MA1030	A		Tilt Axle, Camera, Bearing, Su	4.00000000	4.00000	EA
1	Mtl	7	.ML802			Flanged Bearing, 12mm ID, Spli	2.00000000	2.00000	EA
1	Mtl	8	.MA1031	B		Tilt Axle, Light, Bearing Supp	4.00000000	4.00000	EA
1	Mtl	9	.ML801			Flanged Bearing, 8mm ID, Split	4.00000000	4.00000	EA
1	Mtl	10	.FN824			Dowel Pin, M4x12mm, 316SS	4.00000000	4.00000	EA
1	Mtl	11	.FN823			Washer, 9mm x 15.875 mm x 2.54	4.00000000	4.00000	EA
1	Mtl	12	.MA1032	A		Flanged Mount, ELS, Tilt Mecha	4.00000000	4.00000	EA
1	Mtl	13	.FN878			Screw, M5 x 30mm PHPMS, Polyca	10.00000000	10.00000	EA



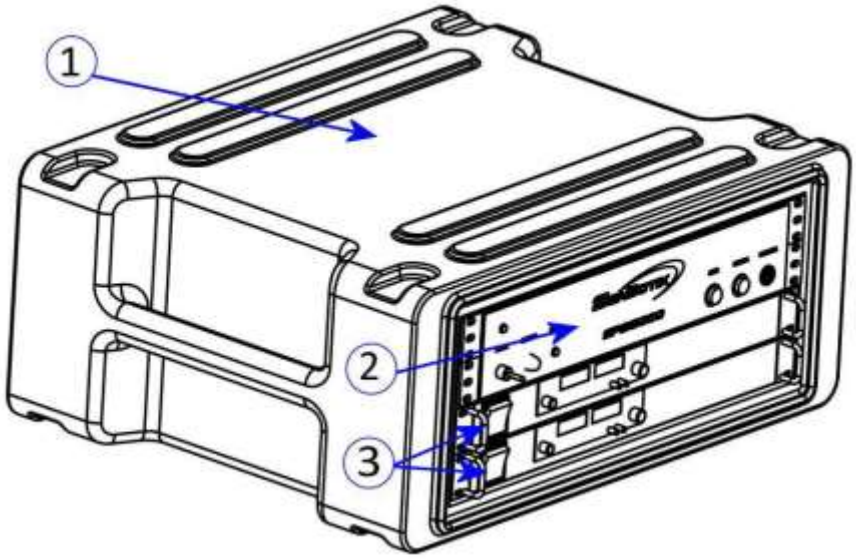
6.2 URS


SCALE 1:8
(NOT USED -000)
DASH | P/N | DESCRIPTION
-000 | URS250 | CORE
-001 | URS251 | W/COPPER HUB (POH610)
-002 | URS252 | W/FOV HUB (POH620)
-003 | URS253 | W/FOP HUB (POH630)
-004 | URS254 | W/FOF HUB (POH640)
N/A -000 (NOT USED)
-001
-002
-003
-004
3. DESIGN CAPACITY: 250M [820FT] OF Ø8.3 [.326] NOMINAL UMBILICAL: 80% FILL
2. WEIGHT OF BAREBONES SYSTEM (URS250) = 9.1KG [20LB, 20 OZ].
1. TEST AND TAG WITH PART NUMBER AND REVSION LETTER.
NOTES: UNLESS OTHERWISE SPECIFIED
SEE SEPARATE BOM, "URS250-URS254BOM"
NONE
SeaBotix Inc
TITLE: UMBILICAL REEL, 250M, ASSY, GEN 2
SIZE B
PART NO. URS250-URS254
REV X3
SCALE: 1:6 WEIGHT: SHEET 1 OF 2

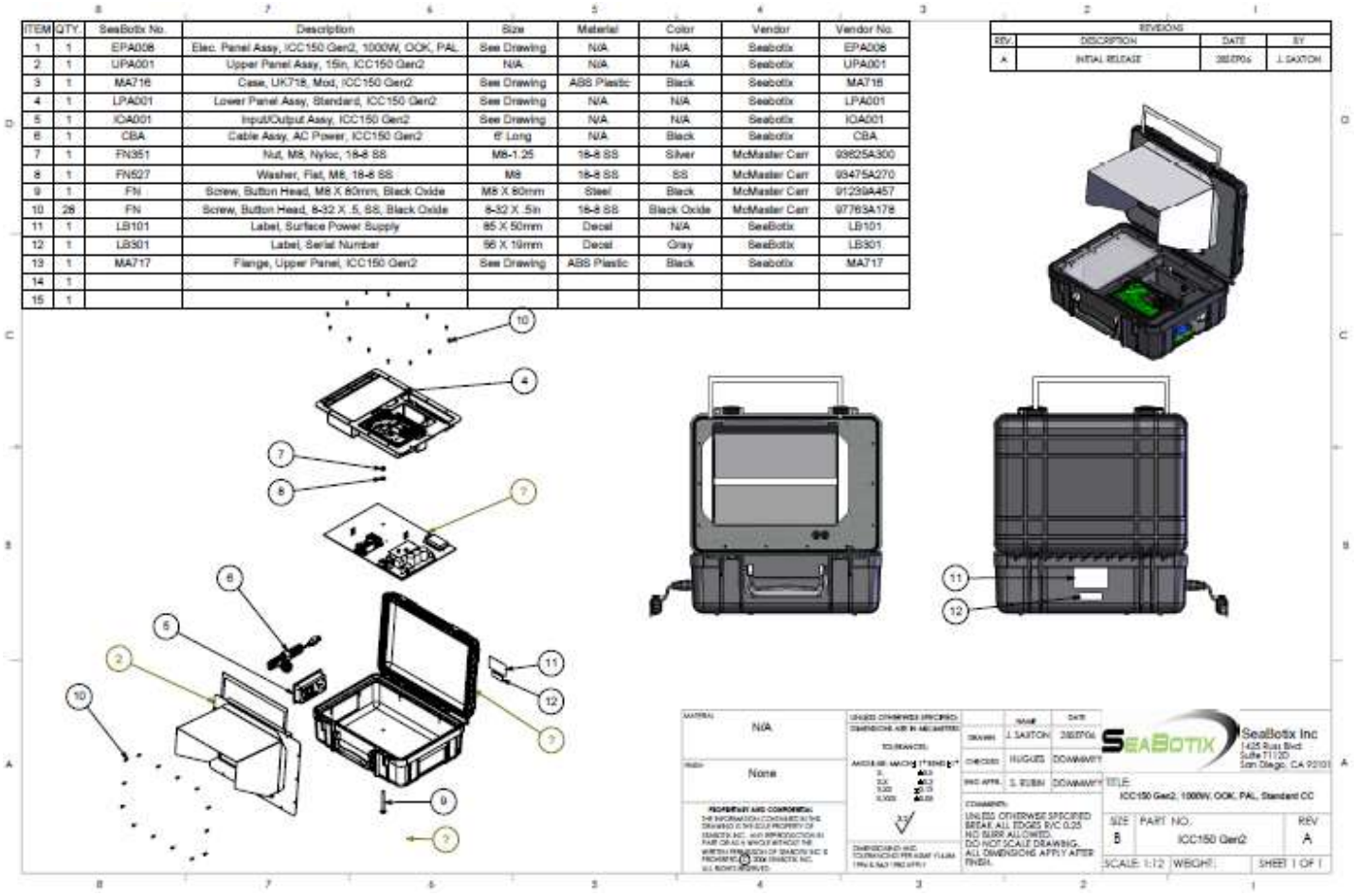
Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			URS250	B		Umbilical Reel, Barebone, 250M		1.00000	EA
1	Asm	10	.DRA601	A		Drum Assy, URS250, Gen 2	1.00000000	1.00000	EA
2	Mtl	10	..AD004			Cement, PVC, Clear 16 oz	1.60000000	1.60000	OZ
2	Mtl	20	..FN128			Screw, M3 X 20, Phillips Flat	8.00000000	8.00000	EA
2	Mtl	30	..FN206			Screw # 6 x .5" Phillips Pan	1.00000000	1.00000	EA
2	Mtl	40	..FN725			Screw, Set, M6 x 12, Cone Poin	4.00000000	4.00000	EA
2	Mtl	50	..MA626	E		Stop Pullout, URS, Gen 2	2.00000000	2.00000	EA
2	Mtl	60	..MA633	A		Flange Drum, URS, Gen 2	2.00000000	2.00000	EA
2	Mtl	70	..MA634	B		Hub Handle, URS, Gen 2	1.00000000	1.00000	EA
2	Mtl	80	..MA635	A		Drum Reel, URS 250, Gen 2	1.00000000	1.00000	EA
2	Mtl	90	..MA685	E		Drum End , Hub, URS175M, Gen 2	1.00000000	1.00000	EA
2	Mtl	100	..MA686	D		Drum End , Handle , URS175M, G	1.00000000	1.00000	EA
2	Mtl	110	..SS171			Primer, PVC, 16 Ounce	0.25000000	0.25000	GR
2	Mtl	120	..SS613			Cable Strap, Nylon, 5/16"	1.00000000	1.00000	EA
1	Mtl	20	.FN003			Washer, Fender, 1/4", Flat, SS	4.00000000	4.00000	EA
1	Mtl	30	.FN131			Washer, M10, 316 SS	4.00000000	4.00000	EA
1	Mtl	40	.FN353			Nut, M6	4.00000000	4.00000	EA
1	Mtl	50	.FN388			Screw, M6 x 25, Button Head	8.00000000	8.00000	EA
1	Mtl	60	.FN611			Screw, 3/8"-16 Hex Bolt 1 1/4"	4.00000000	4.00000	EA
1	Mtl	70	.FN623			Coupling Nut, M6 x 1, SST	8.00000000	8.00000	EA
1	Mtl	80	.FN624			Washer, M6, 18-8 SS	8.00000000	8.00000	EA
1	Mtl	90	.FN629			Standoff, OD 1.00 x ID 0.510,	4.00000000	4.00000	EA
1	Mtl	100	.FN640			Plunger, L-Handle-Locking, M10	1.00000000	1.00000	EA
1	Mtl	110	.FN655			Nut, thin, M10x 1.5, SST	1.00000000	1.00000	EA
1	Mtl	120	.FN658			Washer, M6, Fender, 18-8 SS	8.00000000	8.00000	EA
1	Mtl	130	.FN660			Screw, M6 x 75, Button Head So	4.00000000	4.00000	EA
1	Mtl	140	.LU002	A		Lubricant, Gel Lube	0.50000000	0.50000	OZ
1	Mtl	150	.MA427	B		Spacer Ring, URS, 1/4"	1.00000000	1.00000	EA
1	Mtl	160	.MA638	D		Base, Reel, Slip Ring End, URS	1.00000000	1.00000	EA
1	Mtl	170	.MA639	D		Base, Reel, Handle End, URS, G	1.00000000	1.00000	EA
1	Asm	180	.MA650	B		Support Tube, URS250, Gen 2	4.00000000	4.00000	EA
2	Mtl	10	..FN601			Tubing, Stainless T- 304 .875	1.20000000	4.80000	FT
1	Asm	190	.MA660	B		Threaded Rod, M6, 250 Meters,	4.00000000	4.00000	EA
2	Mtl	10	..FN603			Threaded Rod, M6 x 1	0.31750000	1.27000	M
1	Mtl	200	.ML015	A		Feet, Neoprene, Dampener	4.00000000	4.00000	EA
1	Mtl	210	.ML017	A		Handle, Winch, 8", RED/BLK, UR	1.00000000	1.00000	EA
1	Mtl	220	.SS014			Strap, Velcro, BLK, 8" L x 3/4	2.00000000	2.00000	EA
1	Mtl	230	.SS099			Loctite, 262, Red, High Streng	0.05000000	0.05000	EA

6.3 SPS30XX

Bubble Number	SeaBotix Part Number	Description	Quantity
1	ML086	Rolling Case, Mounting Rack, SPS3000	1
2	SCA103	Control Unit, SPS3003, Gen 2, vLBV 250M Tether	1
3	EC1465	PWR Supply, 600VDC/2.8A, 85-265VAC 1-Phase IN	2

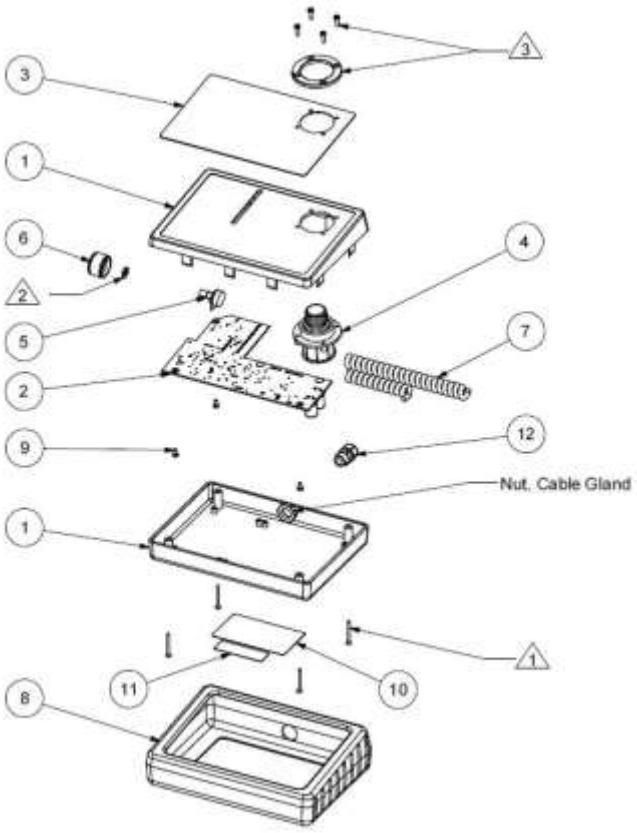


6.4 ICC



ITEM	QTY.	SeaBotix No.	Description	Size	Material	Color	Vendor	Vendor No.
1	1	EPA008	Elec. Panel Assy, ICC150 Gen2, 1000W, OOK, PAL	See Drawing	N/A	N/A	Seabotix	EPA008
2	1	UPA001	Upper Panel Assy, 15in, ICC150 Gen2	N/A	N/A	N/A	Seabotix	UPA001
3	1	MA716	Case, UK718, Mod, ICC150 Gen2	See Drawing	ABS Plastic	Black	Seabotix	MA716
4	1	LPA001	Lower Panel Assy, Standard, ICC150 Gen2	See Drawing	N/A	N/A	Seabotix	LPA001
5	1	IOA001	Input/Output Assy, ICC150 Gen2	See Drawing	N/A	N/A	Seabotix	IOA001
6	1	CBA	Cable Assy, AC Power, ICC150 Gen2	6' Long	N/A	Black	Seabotix	CBA
7	1	FN351	Nut, M8, Nyloc, 18-8 SS	M8-1.25	18-8 SS	Silver	McMaster Carr	93625A300
8	1	FN527	Washer, Flat, M8, 18-8 SS	M8	18-8 SS	SS	McMaster Carr	93475A270
9	1	FN	Screw, Button Head, M8 X 80mm, Black Oxide	M8 X 80mm	Steel	Black	McMaster Carr	91239A457
10	28	FN	Screw, Button Head, 8-32 X .5, SS, Black Oxide	8-32 X .5in	18-8 SS	Black Oxide	McMaster Carr	97763A178
11	1	LB101	Label, Surface Power Supply	85 X 50mm	Decal	N/A	SeaBotix	LB101
12	1	LB301	Label, Serial Number	56 X 19mm	Decal	Gray	SeaBotix	LB301
13	1	MA717	Flange, Upper Panel, ICC150 Gen2	See Drawing	ABS Plastic	Black	Seabotix	MA717
14	1							
15	1							

6.5 OCU (Operator Control Unit) CCA001

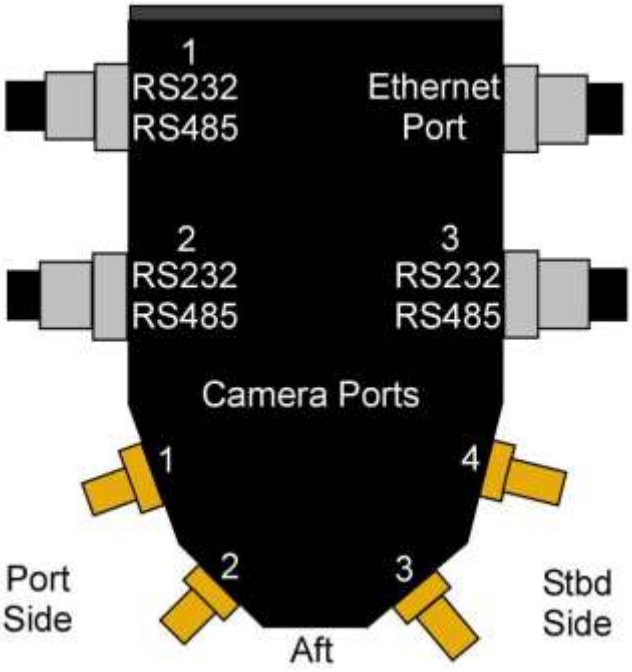


Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			CCA001	C		Operator Control Unit, ICC150,		1.00000	EA
1	Mtl	10	.CB029			Wire, WHT 24AWG, Teflon Strand	0.67000000	0.67000	FT
1	Mtl	20	.CB035			Wire, RED 24AWG, Teflon Strand	0.50000000	0.50000	FT
1	Mtl	30	.CB050			Wire, BLU 24AWG, Teflon Strand	1.00000000	1.00000	FT
1	Mtl	40	.CB053			Wire, BLK 24AWG, Teflon Strand	0.50000000	0.50000	FT
1	Asm	50	.CBA115	B		Retractable Cable, Operator Co	1.00000000	1.00000	EA
1	Mtl	60	.CN012			Conn, Header, 3 Pos, Vertical,	1.00000000	1.00000	EA
1	Mtl	70	.CN013			Conn, Receptacle, 3 Pos, 24 Aw	1.00000000	1.00000	EA
1	Mtl	80	.CN171			Connector, Dust Cover 8 Pos, C	1.00000000	1.00000	EA
1	Mtl	90	.CN316			Conn, Receptacle, 8 Pos, 24 Aw	1.00000000	1.00000	EA
1	Mtl	100	.EC008			Capacitor, Ceramic, 0.1 uF, 50	1.00000000	1.00000	EA
1	Mtl	110	.EC009	A		Pot, 100K, 1 Turn, VPTC	1.00000000	1.00000	EA
1	Asm	120	.EC303	A		IC, MCU, PIC17C56A-33I/L, Prog	1.00000000	1.00000	EA
1	Mtl	130	.FN325			Screw, M3 x 5, Phillips Pan He	2.00000000	2.00000	EA
1	Mtl	140	.FN343			Standoff, M3 x 5, Hex, F/F	1.00000000	1.00000	EA
1	Mtl	150	.FN371			Screw, M3 x 12, Phillips Pan H	5.00000000	5.00000	EA
1	Mtl	160	.FP039	A		PIC, Securing Tab	1.00000000	1.00000	EA
1	Mtl	170	.LB201	B		Label, Control Console	1.00000000	1.00000	EA
1	Mtl	180	.LB301	B		Label, Serial Number	1.00000000	1.00000	EA
1	Mtl	190	.MA043	A		Knob, Control Console, Gen 2	1.00000000	1.00000	EA
1	Mtl	200	.MA202	B		Case, Control Console, Mod, Ge	1.00000000	1.00000	EA
1	Mtl	210	.ML016			Gland, Cable, BLK	1.00000000	1.00000	EA
1	Mtl	220	.ML204	D		Boot, Control Console	1.00000000	1.00000	EA
1	Asm	230	.PCA008	G		Assy, PCT, Operator Control Un	1.00000000	1.00000	EA
1	Mtl	240	.SS035			Heat shrink, 3/8" OD, 2:1 Blac	0.16666666	0.16667	FT
1	Mtl	250	.SW208	B		Keypad, Control Console, Engli	1.00000000	1.00000	EA
1	Mtl	260	.SW210			Joystick, Control Console, Tal	1.00000000	1.00000	EA

Addendum A: Standard vLBV Port manifold connections.

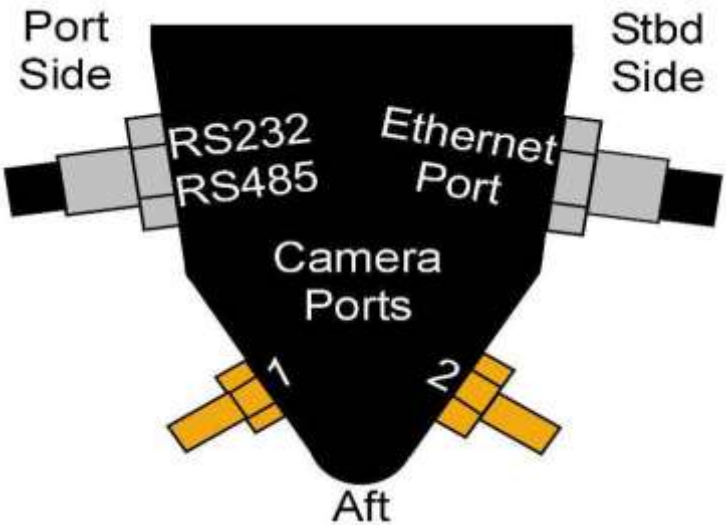
MAN001 Eight Port Manifold

Fwd

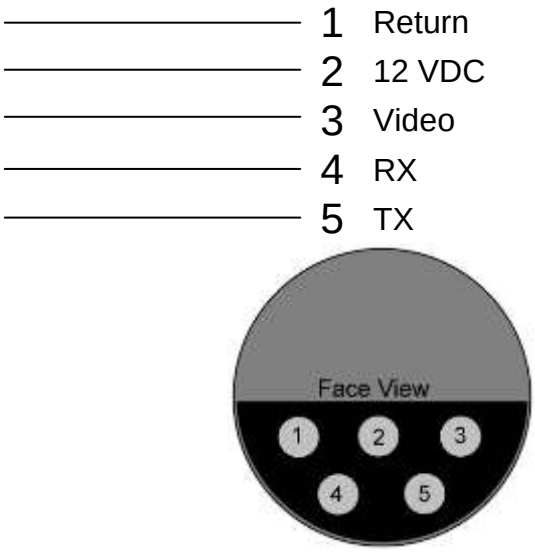


MAN002 Four Port Manifold

Fwd



Addendum B: Video bulkhead connection wiring diagram.



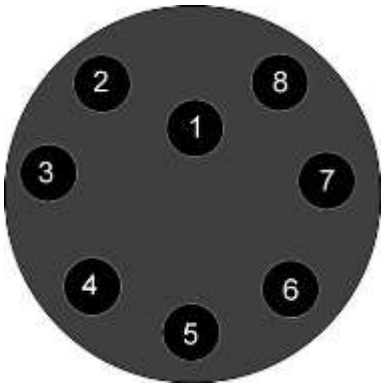
Addendum C: Ethernet bulkhead connection wiring diagram.

1	TX-P
2	TX-N
3	RX-P
4	RX-N
5	28 VDC
6	Return

Face View

Addendum D: Serial Port RS232 and/or RS485 bulkhead connection wiring diagram.

1	Return
2	RS232 Rx
3	RS232 Tx
4	28 VDC
5	Return
6	12 VDC
7	RS485 A/Y
8	RS485 B/Z



Face View

Addendum E: vLBV300 Copper

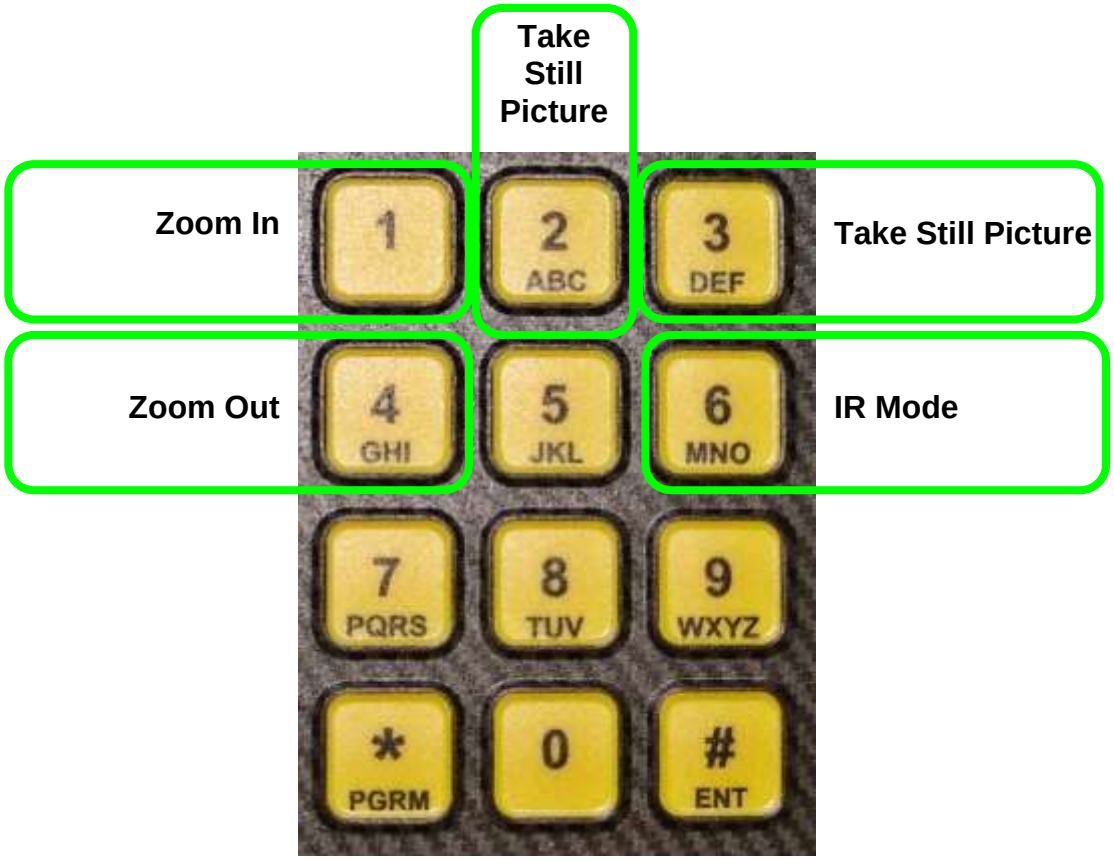
	Attach and secure the shackle to the top of the vLBV. Use the shackle with the ring attachment.
	Attach and secure the shackle to the rear of the vLBV. When attaching, ensure that the pin in inserted from the top. This ensures that the shackle does not become detached should the lock become disengaged during deployment.
	Connect the tether connector to the vLBV E-Bottle. The connection will be at the top center of the E-Bottle on the rear, and will be blue in color. Align the keyway for the connector, and rotate the locking collar till it is finger tight. Do Not use tools to tighten, damage to the connector will occur.

Addendum F: SubC 1CamX HD Camera Controls

The SubC 1CamX HD camera is controlled via keypad entry on the Operator Control Unit.

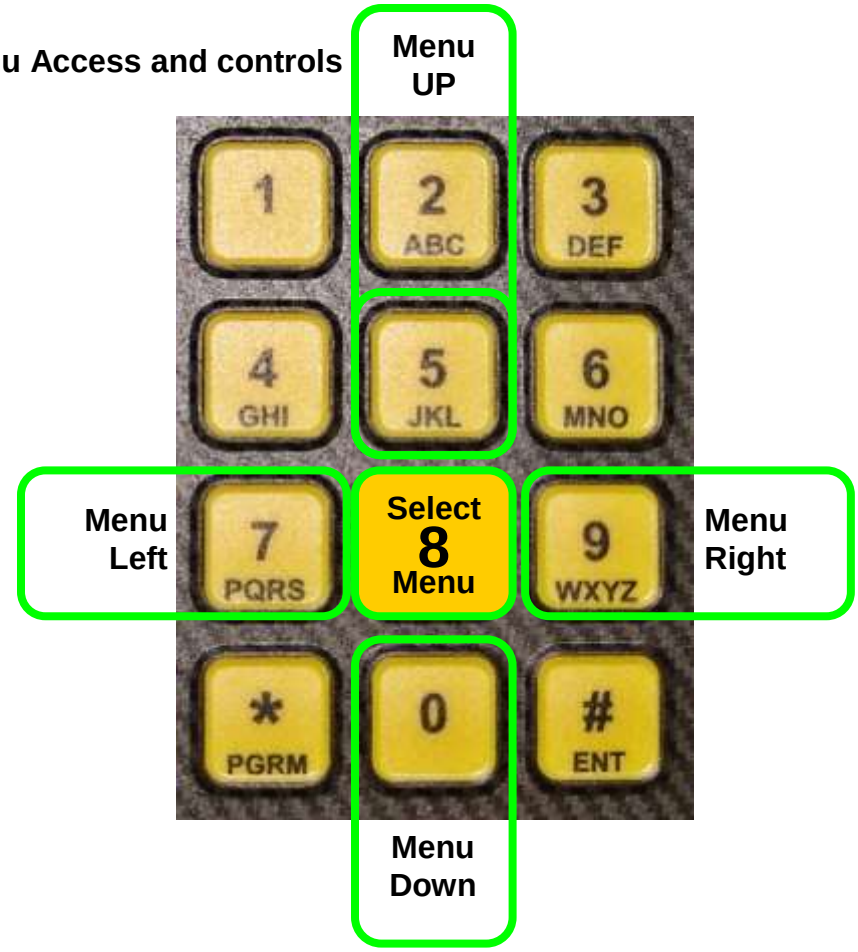
To activate the controls, the operator will select HD via the select button on the Operator Control Unit. Once HD is displayed in the selected accessory position on the video overlay, the operator can utilize the numeric keypad of the Operator Control Unit to control the available functions of the camera as shown in the tables below.

A. Camera Operational Controls



NOTE: There are no on screen indicators that a picture has been taken or that recording is in progress.

B: Camera Menu Access and controls

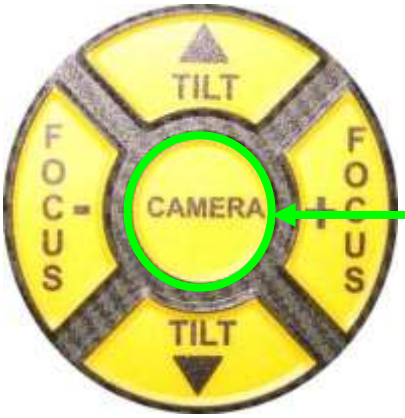


C: Setting up SubC 1CamX for operation and control

Step	Action		
1	Press *	* PGRM	Open vLBV Menu Screen
2	Press 0	0	Select Main Menu
3	Press 4	4 GHI	Select Options
4	Press 5	5 JKL	Select Camera Type
5	Press 5	5 JKL	Select Zoom
6	Press 3	3 DEF	Select HD
7	Press #	# ENT	Enter
8	Press *	* PGRM	Exit Menu

D: Selecting the 1CamX for display:

Press and hold the camera button on the OCU



Select Number 5 on the keypad

Refer to Section 2.17 of this manual for additional information on camera selection.

Addendum G: ARIS Tool Skid

With the ARIS Tool Skid option, the operator can roll the sonar head up to 90^{o} either port or starboard. The skid also allows the operator to pitch the sonar head up or down up to 25^{o}. This allows the operator to obtain greater target definition and increases system flexibility for investigating sonar targets

The tilt and roll functions of the Tool Skid are controlled via the ACCESSORIES selection of on the Operator Control Unit.

A. Roll Control

Press the **SELECT** button on the Operator Control Unit

Verify that the overlay shows RS in the accessory position

The left arrow will roll the sonar to port and the right arrow will roll the sonar to starboard

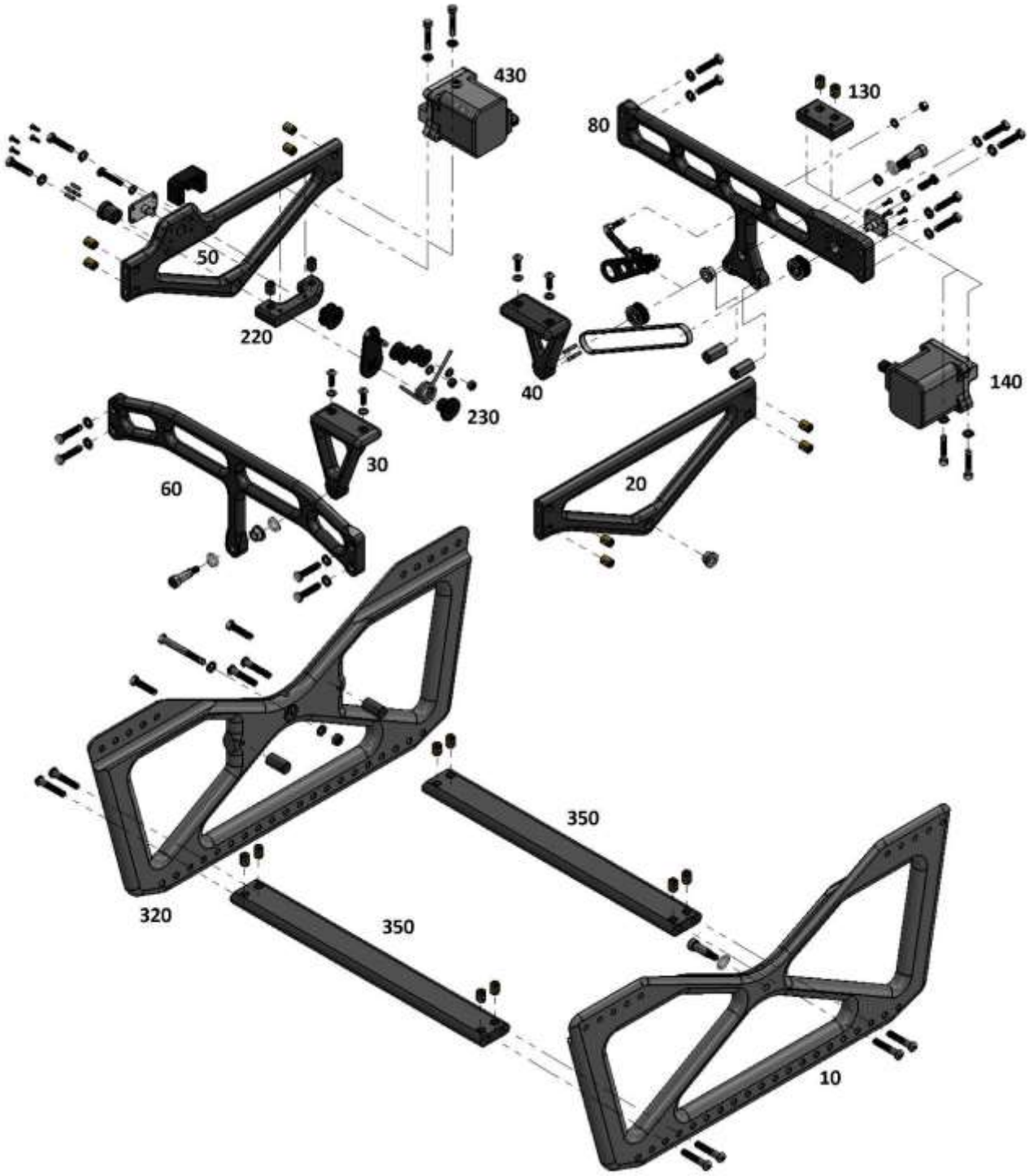
B. Pitch Control

Press the **SELECT** button on the Operator Control Unit

Verify that the overlay shows PS in the accessory position

The left arrow will pitch the sonar down and the right arrow will pitch the sonar up

C. Exploded Parts Diagram



D. Parts List

Lvl	Typ	Seq	Part Number	Revision	Alt	Description	Qty/Parent	Required Qty	UM
			RFA001	B		Rotator Frame Assembly		1.00000	EA
1	Mtl	10	.MA1501	A		Bracket, Side, Skid, Lower, Le	1.00000000	1.00000	EA
1	Mtl	20	.MA1500	A		Bracket, Rotator, Left, Skid	1.00000000	1.00000	EA
1	Mtl	30	.MA1498	A		Bracket, Front, Rotator	1.00000000	1.00000	EA
1	Mtl	40	.MA1508	A		Bracket, Rear, Rotator	1.00000000	1.00000	EA
1	Mtl	50	.MA1510	B		Bracket, Rotator, Right, Skid	1.00000000	1.00000	EA
1	Mtl	60	.MA1499	B		Bracket, Rotator, Front, Skid	1.00000000	1.00000	EA
1	Mtl	70	.FN853			Washer, 8mm, Wave, SS	4.00000000	4.00000	EA
1	Mtl	80	.MA1509	B		Bracket, Rotator, Rear, Skid	1.00000000	1.00000	EA
1	Mtl	90	.FN264			Dowel Pin, 3mm X 12mm, 316 SS	12.00000000	12.00000	EA
1	Mtl	100	.FN262			Bearing, Flanged, 8mm ID, 12mm	3.00000000	3.00000	EA
1	Mtl	110	.MA1507	A		Pulley, Pin, T2.5, 28 Groove,	2.00000000	2.00000	EA
1	Mtl	120	.MA1513	A		Block, Stop	4.00000000	4.00000	EA
1	Mtl	130	.MA1506	A		Bracket, Motor Adaptor	1.00000000	1.00000	EA
1	Asm	140	.MHA003	C		Motor Housing, Roll Assembly w	1.00000000	1.00000	EA
1	Mtl	150	.FN690			Bolt, M5 x 30mm, SHCS 316 SS	4.00000000	4.00000	EA
1	Mtl	160	.MA1505	A		Bracket, Pulley, C, ROV Frame	1.00000000	1.00000	EA
1	Mtl	180	.MA1496	A		Pulley, Drive, T2.5, 28 Groove	1.00000000	1.00000	EA
1	Mtl	190	.ML432			Belt, Timing, T2.5, 152 Teeth,	1.00000000	1.00000	EA
1	Mtl	200	.MA1503	A		Bracket, Pulley, A, ROV Frame	1.00000000	1.00000	EA
1	Mtl	210	.MA1497	A		Pulley, Drive, T2.5, 19 Groove	1.00000000	1.00000	EA
1	Mtl	220	.MA1531	A		Motor Mount, Starboard Side, A	1.00000000	1.00000	EA
1	Mtl	230	.MA1533	A		Pivot Axle, Starboard Side, AR	1.00000000	1.00000	EA
1	Mtl	240	.FN250			Screw, M6 X 50, BHCS, 18-8 Sta	1.00000000	1.00000	EA
1	Mtl	250	.FN323			Nut, M6, Nyloc	1.00000000	1.00000	EA
1	Mtl	260	.ML435	A		Belt, 2.5 Pitch X 330mm Pitch	1.00000000	1.00000	EA
1	Mtl	270	.FN422			Washer, .2" ID, .44" OD, Plast	4.00000000	4.00000	EA
1	Mtl	280	.FN387			Screw, M6 x 20, Button Head 18	2.00000000	2.00000	EA
1	Mtl	290	.FN692			Washer, M5, 10mm OD, 316 SS	4.00000000	4.00000	EA
1	Mtl	300	.FN833			Washer, M6, Flat, 316SS	18.00000000	18.00000	EA
1	Mtl	310	.FN836			Screw, M3-0.5 x 30mm, FHCS, 31	8.00000000	8.00000	EA
1	Mtl	320	.MA1502	A		Bracket, Side, Skid, Lower, Ri	1.00000000	1.00000	EA
1	Mtl	340	.FN260			Insert, M6 X 9mm, Brass	22.00000000	22.00000	EA
1	Mtl	350	.MA1512	A		Bar, Spreader, ROV Frame	2.00000000	2.00000	EA
1	Mtl	360	.FN224			Screw, M6 X 30 BSHC, 316 SS	14.00000000	14.00000	EA
1	Mtl	380	.FN391			Screw, M5 x 16, Button Head 18	4.00000000	4.00000	EA
1	Mtl	400	.FN266			Screw, M6 X 20mm, SHCS, 8mm Sh	3.00000000	3.00000	EA
1	Mtl	420	.FN395			Screw, M6 x 35, Button Head	8.00000000	8.00000	EA
1	Asm	430	.MHA004	D		Motor Housing, Pitch Assembly,	1.00000000	1.00000	EA

Addendum H: Power Management Settings vs. Tether Length

The purpose of this addendum is to enable the user to control the power limit settings inside the vLBV.

With longer tethers, it is possible for the system to draw more current than can be provided thru the tether with the result being insufficient power delivered to the vLBV.

The effect is a power reboot of the vLBV when voltage drops below the threshold needed to power the vLBV internal power supplies.

To prevent this follow the instructions below for each tether length

350 meter tether length

A		Turn on the system Select the PGM (*) key to bring up the menu options page Enter 83 to bring up the Vehicle Power Menu Select menu option 1.
B		Type 1400 Press enter (#) to set the new value Select menu option 1 to verify the setting Press the * key to return to vLBV operations

500 meter tether length

A		Turn on the system Select the PGM (*) key to bring up the menu options page Enter 83 to bring up the Vehicle Power Menu Select menu option 1.
B		Type 1100 Press enter (#) to set the new value Select menu option 1 to verify the setting Press the * key to return to vLBV operations

750 meter tether length

A		Turn on the system Select the PGM (*) key to bring up the menu options page Enter 83 to bring up the Vehicle Power Menu Select menu option 1.
B		Type 1000 Press enter (#) to set the new value Select menu option 1 to verify the setting Press the * key to return to vLBV operations

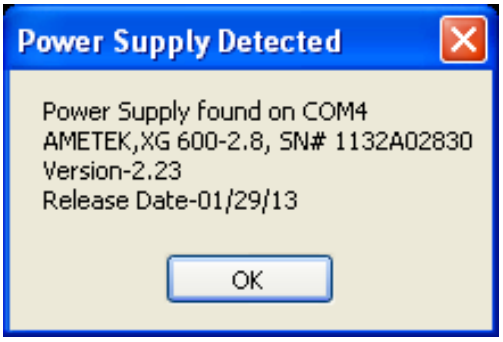
1250 meter tether length

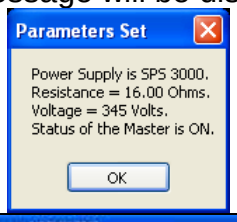
		Turn on the system Select the PGM (*) key to bring up the menu options page Enter 83 to bring up the Vehicle Power Menu Select menu option 1.
		Type 800 Press enter (#) to set the new value Select menu option 1 to verify the setting Press the * key to return to vLBV operations

Addendum I: Programming the AMETEK Power Supplies

A: Master AMETEK Setup

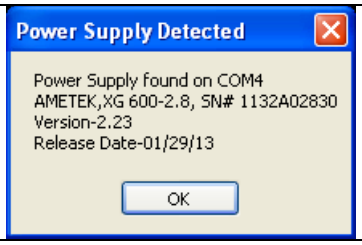
NOTICE	***DO NOT click the "RESET TO DEFAULT" button!*** Equipment damage may result.

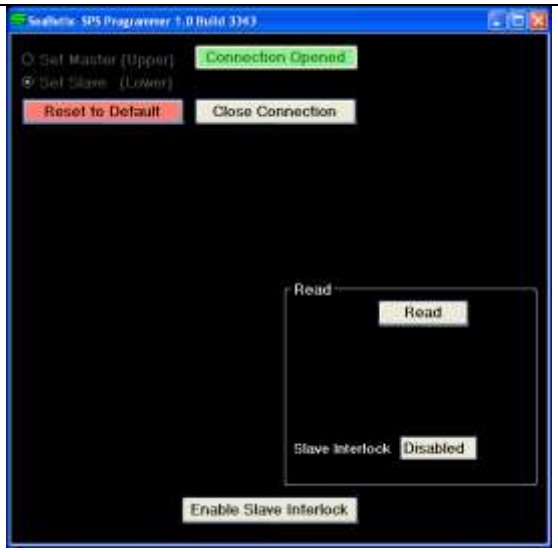
A.1: Measure the resistance of each primary lead Pins 2 & 3 of the tether with a multi-meter from one end of the tether to the other	1.a Pin 2-2 resistance _____ Ω (Ohms) 1.b Pin 3-3 resistance _____ Ω (Ohms)
A.2: Install SPS Programmer	This software is installed at the factory for all systems delivered with the INC. The software will be found in the start menu in the SeaBotix folder
A.3: Setting up the Master AMETEK	**a.** Connect Master AMETEK to PC/INC via USB A-A cable **b.** Turn on AMETEK
A.4: Configure Master AMETEK Using SPS Programmer **a. Open SPS Programmer** **b.** Select Master. Click **"Open Connection"** - Message will appear asking you to confirm that the AMETEK is connected via USB cable. Click **OK**. - Programmer will search for the connected AMETEK - SPS Programmer will connect to AMETEK and display this message. - Click **OK**.	 NOTE: SN# and Version will be different from the example above. This information is unique to each AMETEK
A.5: Input values for the Master AMETEK (fields highlighted in green.) Tether number can be found printed on the jacket of the tether Tether length can be found on your sales order, or if repaired, on the repair work order Enter the value measured in Step 1.a in the block for Resistance 1 Enter the value measured in Step 1.b in the block for resistance 2 NOTE: Ignore any information displayed in the "Read" box.	**a.** Input all fields **EXAMPLE:**

A.6: Click **"Write Parameters"** Click **OK**.	The following message will be displayed. 
A.7: After you click **OK** the information in the "**Read**" box should match the information you entered in the other boxes. Resistance should equal the sum of Resistance 1 and 2 in the **"Tether Parameters"** Box.	

If only installing a new length tether to the system, do not perform procedure B: Setting up the Slave Power Supply go directly to procedure C: Verifying Voltage

B: Slave AMETEK Setup

NOTE: Follow these steps after installing NEW or replacement AMETEKS ONLY. Do not perform these steps if only changing tether length	
B.1: Install SPS Programmer	This software is installed at the factory for all systems delivered with the INC. The software will be found in the start menu in the SeaBotix folder
B.2: Setting Up the Slave AMETEK	**a.** Connect Slave AMETEK to PC via USB **b.** Turn on AMETEK
B.3: Configure Slave AMETEK Using SPS Programmer	**a.** Open SPS Programmer **b.** Select Slave. **c.** Click **"Open Connection"** - Message will appear asking you to confirm that the AMETEK is connected. Click **OK**. - Programmer will search for the connected AMETEK
B.4: SPS Programmer will connect to AMETEK and display the following message. Click **OK**	

B.5: Click “Reset to Default”	 You will be asked to confirm reset. Click “**OK**

C: Verify Voltage and Current Output

C.1 Connect tether to SPS

NOTICE **Do not connect the vehicle prior to performing these tests. Equipment damage could result**

C.2 Turn on SPS as per instruction manual.

- Power up the system by pressing the power button on the OCU (Operator Control Unit)

C.3 Display Voltage should read approximately 345v

C.4 Display Current should read approximately 0 amps

C.5 Take voltage reading at the wet end of tether between Socket 2 (black lead) and Socket 3 (red lead). Voltage should read approximately 345VDC +/- 1%

Note: The multi-meter must be set to read volts DC and on a scale that will read at least 360VDC.

- If voltage is incorrect verify reading and repeat programming procedure.

C.6 Shut down power. **Continue to Slave AMETEK Setup if necessary.**

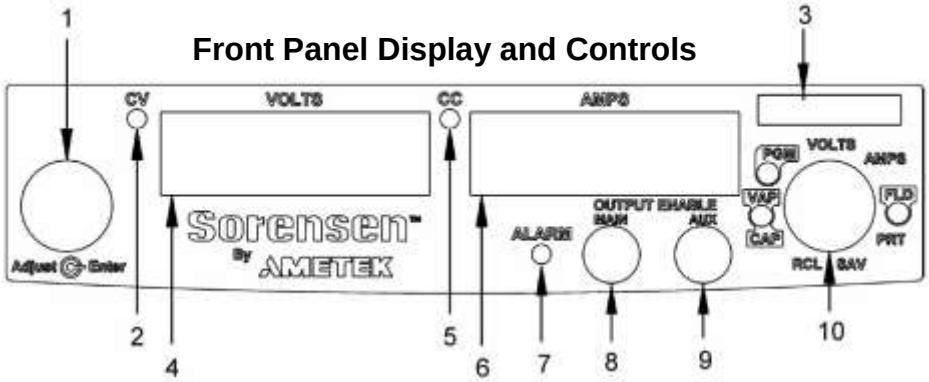
C.7 Connect the tether to vehicle. **System is ready for operation.**

Front Panel Setup

Steps	Setting	Master	Slave
1	VOLTS	0	630
2	AMPS	2.80	2.80
3	FLD	None	None
4	PRT, OVP	630	660
5	PRT, UVP	0	0
6	PRT, OTP	OFF	OFF
7	PRT, SD	1	1
8	CAPR	OFF	OFF
9	VAPR, VNIS	OFF	OFF
10	PGM, USB	1	1
11	PGM, CURR SHAR	CONT	SLA
12	Press and hold the **OUTPUT ENABLE Main** until ***AS On*** or *AS OFF* is displayed. Set to ***AS On*** for all power supplies		
13	Press and hold the **OUTPUT ENABLE Aux** until ***AUAS On*** or *AUAS OFF* is displayed. Set to ***AS On*** for all power supplies		
14	PGM, LOCLLOC	ON	ON

NOTE: For Fine Adjust, press Adjust/Enter knob once.
Press Adjust/Enter knob after entering values once more to set value.

Front Panel Display and Controls



Item Description	
1 Rotary Adjust/Enter control	**2** Constant Voltage (CV) Mode LED (green)
3 Model Identification Label	**4** Output Voltage Display
5 Constant Current (CC) Mode LED (green)	**6** Output Current Display
7 Alarm Indicator LED (red)	**8** OUTPUT ENABLE Main button
9 OUTPUT ENABLE Aux button	**10** 9-Position Mode Control (For detailed information, see “Configuring Settings from the Front Panel”)

STEP 1: Input Front Panel Settings
Input front panel setting as per table above**.**

NOTE: This portion of the procedure only applies when required after replacement of one or both of the AMETEK power supply modules

Perform A: Master AMETEK Setup
Perform B: Slave AMETEK Setup

Glossary of Abbreviations

The following abbreviations and terms are used when discussing the vLBV and accessories.

BNC	Video Input and Output connectors used by SeaBotix.
Bulkhead Connector	**Bulkhead Connectors** are devices for connecting external devices to the vLBV electronics. It is a physical connector that is mounted and acts as a seal for the housing.
CHA	**Camera Chassis Assembly:** The portion of the LBV housing the Camera/Camera's as well as the control electronics. It is encased in a clear poly carbonate view port. Located at the forward end of the LBV.
CSA	**Crawler Skid Assembly**, a subassembly of the LBV150SE-5 system that allows the operator to attach the LBV to any relatively flat surface for stability while performing inspections.
DTA	**Depth and Temperature Assembly.**
EB A	**Electronics Bottle Assembly**
ELS	**External Lighting System.**
Flash Program	Operational program for the LBV/vLBV.
FO	**Full Fiber Optic data and video**. All data to and from the LBV/vLBV and the video feed from the LBV/vLBV is transferred via fiber optic transmission.
FOE	**Fiber Optic Ethernet data.** This designation is utilized for systems requiring an Ethernet data link to transfer data from the LBV/vLBV.
FOV	**Fiber Optic Video**. This style is used for all tethers. The composite video signal from the LBV is converted to fiber optic data in the tether and made available as a composite signal at the Pull Out Hub of the Tether Reel System.
FSK	**Frequency Shift Keying**. A method of data transmission utilizing 2.5 channels of RS232 format for command and control of the LBV, Data transmission to an external RS232 device, with a remaining simplex channel for data to a device attached to the LBV.
GAK	**Grabber Attachment Kit.** Consists of the Parallel Jaws, the Standard Interlocking Jaws and the Cutter Jaws. These attachments can be installed on the manipulator to meet the operational needs of the user.
Hardware	All hardware descriptions prefixed with the letter M (M5x15) indicates the fastener is a metric fastener. The first number is the diameter in mm (Millimeters,) and the second number is the fastener length in mm. Hardware listed at ¼-20 x 1.5 are imperial fasteners. The first number is the diameter, the second number is Threads per Inch, and the final number is length. Smaller Imperial fasteners are numbered, for example the seal screw utilized on thrusters, grabbers and the vacuum port is a 10-32 x 3/8, so a #10 Screw, with 32 Threads per Inch, and 3/8's of an inch of overall length.
Horiz	**Horizontal**
HPDC	**High Performance Brushless Thruster**
HPDC100	**High Performance Brushless Thruster** with 100 mm propellers

ICC	**Integrated Control Console.** This console is used for command and control of the LBV, and video display only. It has external data connections for exporting SONAR and Tracking to a separate display device.
INC	**Integrated Navigational Console**, a one unit solution for operators of LBV/vLBV's equipped with SONAR and or Navigation systems. The monitor displays both the LBV/vLBV video, and the SONAR/Tracking information on a single monitor. It is also equipped with a hard drive, and video recording equipment, so the information can be recorded into a single file on the hard drive.
LBL	**Long Base Line** systems utilize three or more acoustic transponders on the seafloor to communicate with a beacon on the ROV. By triangulation with the ship (and its GPS), the position of the transponders can be accurately determined and then used to determine the position of the ROV. LBL is the most accurate type of acoustic tracking system but has several drawbacks including the lengthy time to set up and calibrate the cost of multiple transponders, and the ability to only track the ROV when it is within range of all of the seafloor transponders. A variant of this approach is inverted LBL which uses transponders on surface buoys (each with GPS receivers) instead of ones on the seafloor.
LBV	Little Benthic Vehicle
lwLARS	**Light Weight Launch and Recovery System.** A self contained Tether management system, with operator controlled automated payout and recovery of the Tether and LBV/vLBV.
MB	**Mother Board**
MUX	**Multiplexer.** This function is contained in the POH and converts the fiber data to electrical data prior to the slip ring assembly, for use by the operator.
NCC	**Navigation Computer Console**. A computer and display console developed for display and control of SONAR and Tracking systems. It is used in addition to the ICC.
OCU	**Operator Control Unit**
OOK	**On-Off Keying**. The simplest method of command and control of the LBV with no additional data channels. Utilizing RS232 duplex from the OCU to the LBV via the Surface Power Supply.
PCA	Printed Circuit Card Assembly
Penetrator	In a penetrator style connection, the cable actually passes into the housing of the unit without a connector. This is used when connecting an external device to circuitry inside the sealed housing.
PIC	**Programmable Integrated Circuit** Used on the circuit boards to pre-program them for functions as required.
POH	**Pull Out (multiplexer) Hub**. Part of the URS. It contains the MUX, as well as the termination point for the Tether and the Tether whip.
PSI	Power Supply Interface circuit board: part of the VPS
QRS	**Quick Recovery System**. A secondary manual system used to easily recover the LBV by attaching to the tether allowing the operator to recover the system without handling the tether directly.
RF	**Radio Frequency**

RF Coupler	**Radio Frequency Coupler Board**. Used in non FO LBVs' to couple and decouple data to the tether.
RF Demod	**Radio Frequency De-Modulator.** Used in non FO & FOV LBV's to convert the RF video signal to composite video for display.
RF Mod	**Radio Frequency Modulator.** Used to up and down convert the RS232 data from the OCU and the LBV to RF for data transmission via the tether.
ROV	Remotely Operated Vehicle
RS232	Computer interface communications mode
SB	**Sensor Board**. Used to convert the analog data signals from the internal and external LBV sensors to digital format for display and utilization by the "Auto" modes of the LBV.
SBL	**Short Base Line:** These systems consist of one beacon on the ROV and three or more hydrophones hanging over the side of the ship, dock, or other surface structure. SBL systems have the advantage of not needing to deploy and calibrate seafloor transponders. It has accuracies and costs that are intermediate to the other two methods, LBL or USBL.
SBT	**Standard Brushed Thruster**
SN319	**Tri-Tech Gemini Multi-Beam SONAR**: This SONAR device is a multi-beam. It provides a **real time** image for its full horizontal (120^o) and vertical (20^0) aperture. Since the update rate is continuous for the full aperture, the strengths of this device are: 1. Search while moving. 2. Higher target image resolution making target identification easier for an operator.
SPS	**Surface Power Supply**
TSA500	**Blue View Multi-Beam SONAR.** This SONAR device is a multi-beam. It provides a **real time** image for its full horizontal (45^o , 90^o or 130^o) and vertical (20^0) aperture. Since the update rate is continuous for the full aperture, the strengths of this device are: 1. Search while moving. 2. Higher target image resolution making target identification easier for an operator.
TSS750	**Micron Scanning SONAR.** This SONAR device is a scanning or searchlight style SONAR. It has a maximum range of 100 meters, with a vertical beam-width of 32 degrees. It has the advantage of being able to search in 360 degrees around the ROV, but update rate is range dependant. The system can only display target information for where the acoustic transmitter/receiver is pointed at the time.
SONAR	**Sound Navigation and Ranging.** SeaBotix offers 3 primary versions of SONAR for installation. 1. Micron Scanning SONAR. (TSS750) 2. Blue View Multi-Beam SONAR. (TSS500) 3. Gemini Multi-Beam SONAR (SN319)
SPS	**Surface Power Supply**. Converts supply AC power to DC at ~360VDC for transfer to the LBV/vLBV via the tether.
SPS3000	**3000 Watt Surface Power Supply**. Converts supply AC power to DC at

Series	~360VDC for transfer to the LBV/vLBV via the tether used on all 6 thruster LBV/vLBV.
TJG	**Three Jaw Grabber**
TMS	**Tether Management System**
Tracking	**Acoustic Tracking Systems** Since GPS signals do not penetrate through water, acoustic methods have been devised to allow the operator to know the position of his LBV/vLBV at all times. This is helpful for a variety of reasons including navigating search patterns and re-locating underwater objects. All acoustic tracking systems rely on beacons which can be; pingers, which emit a sound pulse at a predetermined interval, transponders which emit a pulse in response to a specific acoustic interrogation pulse, or responders whose pulse is triggered via an electrical signal from the surface. The beacon(s) pulse is detected by a hydrophone suspended from the surface a computer or controller then determines range and bearing. There are 3 basic configurations for tracking systems. **LBL, SBL** & **USBL** (Refer to each section for further definition.)
uLARS	**Un-Manned Launch and Recovery System**. A remotely controllable launch and recovery system. Consisting of a tether reel system, surface power supply, a power sheave, and control circuits for remote launch and recovery of the LBV system.
UMB	**Tether**
URS	**Universal Reel System**
USBL	**Ultra-Short Baseline** systems are similar to SBL, except instead of using the three surface hydrophones, a single multi-element transducer array is used. This makes them the quickest tracking system to set up and the least expensive of the three methods, although their accuracy is not as high. USBL systems have proven to be the most popular acoustic tracking system used on Mini-ROVs and several companies now make USBL systems specifically for this platform.
Vert	**Vertical**
VGA	**Video Graphics Array** A computer format for displaying video.
vLBV	**Vectored Little Benthic Vehicle**
VOB	**Video Overlay Board.** Creates the characters for displaying the video overlay information from the LBV to the monitor.
VPS	**Vehicle Power Supply.** Converts the ~360VDC tether supply voltage to the 28VDC required for LBV operation.

Liability

SeaBotix Inc. shall not be held liable for improper use of the vLBV and any resulting damages, injuries or losses as a result of the improper use of the vLBV. Additionally, SeaBotix Inc. shall not be held liable for any damages, injuries, losses or problems associated with a vLBV system that has been modified without written consent from SeaBotix Inc.

Warranty

SeaBotix Inc. has a strong commitment to the high quality production of vLBV. Each vLBV system has a 24 month or 500 hour, whichever comes first, limited warranty against defects in workmanship or materials with the exception of those outlined in the limitations and exclusions. The purchaser of vLBV must supply to SeaBotix Inc. or an authorized representative the system including proof of ownership. SeaBotix Inc. will repair or replace at its discretion the defective components.

Limitations and Exclusions

- The limited warranty does not cover damage caused by improper use, poor maintenance or accidental damage to the vLBV.
- The limited warranty does not cover items subject to wear including but not limited to view ports, outer shells, o-rings, batteries, protective bumper frame, Tether and propellers unless found to be defective in workmanship and/or materials.
- The limited warranty does not cover any modification made to the vLBV without authorization from SeaBotix Inc.
- The limited warranty does not cover lamps.
- The limited warranty does not cover components damaged due to incorrect power connection per user's manual.

Shipping Charges

All returns for warranty service must be authorized by SeaBotix Inc. and will be assigned a RMA (Returned Materials Authorization) number which must be clearly indicated on each item returned for service.

After 30 days the client is solely responsible for shipping to and from SeaBotix Inc. warranty center. There are warranty centers around the world to help reduce the distance a product must travel for warranty or service.

Return Policy

SeaBotix Inc. is strongly committed to the high quality production of the vLBV. Customer satisfaction is our top priority. To achieve this goal, SeaBotix Inc. is happy to offer a full refund on any of its standard products returned within 30 days of the date the items were shipped. If for any reason you are not satisfied with our products, simply notify us by calling +1 (619) 450-4000 or email: service@seabotix.com. SeaBotix Inc. will immediately issue a Return Material Authorization (RMA) number. When calling for an RMA number please have the following information ready:

1. The name of owner.

2. The name of distributor, if any.
3. The product being returned.
4. The product serial number/s.

Items being returned must be in AS NEW condition. “AS NEW Condition” means that there are no scratches, marks or blemishes on the item; there are no signs of wear on the product, or the cases; the product must not have been altered in any way. These following conditions must be met by you.

- Return the merchandise to us within 30 days of the date the items were shipped.
- The product must be returned in new, resalable condition*.
- You must include all packaging materials.
- Packaging materials must not be torn or damaged.
- All manuals must be unmarked.
- You must pay any return shipping expense.
- Display the RMA # prominently on the outside of the box to avoid delays to your refund.

Upon receipt of the returned merchandise in good order in accordance with the above and within 30 days of original shipping date, SeaBotix Inc. will refund the money.

Testing

Each vLBV system is carefully manufactured to ensure long and safe operation. Prior to shipment every vLBV system is pressure tested to full operating depth and every item operationally tested.

Should a defect be found, immediately contact SeaBotix Inc. or your authorized distributor.

Design and Documentation Changes

SeaBotix Inc. reserves the right to make changes to the specifications of vLBV at any time without notice. Also, SeaBotix Inc. may alter any or all documentation without notice.